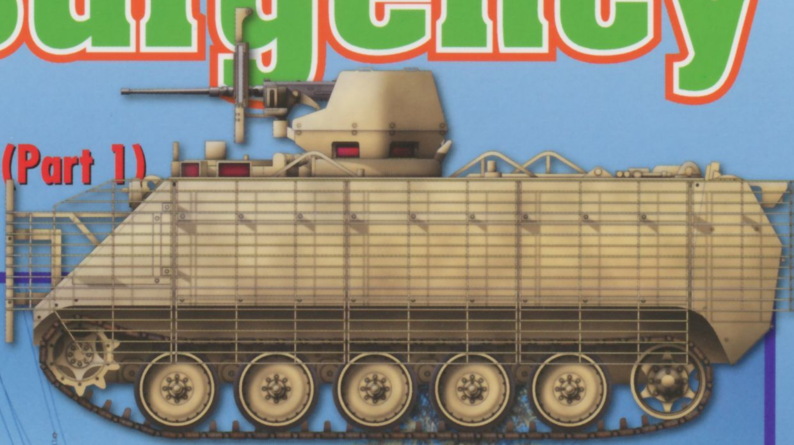
MINI COLOR SERIES 7518

Iraq Insurgency

U.S. Army Armored Vehicles in Action (Part 1)

Carl Schulze



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Abbreviations

ACAV	Armored Cavalry Assault Vehicle
AOO	Area of Operation
AP	Armor Piercing
APC	Armored Personnel Carrier
ARL	Army Research Laboratory
ASK	Armor Survivability Kit
ASV	Armored Security Vehicle
BIAP	Baghdad International Airport
BMP	Bradley Modernization Plan
CENTCOM	Central Command
CFLCC	Combined Forces Land Component Command
CFV	Cavalry Fighting Vehicle
CIV	Commander's Independent Viewer
CTIS	Central Tire Inflation System
CPC	Command Post Carrier
CROWS	Common Remotely Operated Weapon Station
DSESTS	Direct Support Electronic Test Set
ECV	Expanded Capacity Vehicle
EFT	External Fuel Tank
ERA	Explosive Reactive Armor
EO	Electro-Optical
EOD	Explosive Ordnance Disposal
FBCB2	Force XXI Battle Command Brigade and Below
FIST	Fire Support Team
FOB	Forward Operating Base
FPB	Front Protection Bumper
GCS	Ground Control Station
GPS	Global Positioning System
GSTAMIDS	Ground Standoff Mine Detection System
HEMTT	Heavy Expanded Mobility Tactical Truck
HETS	Heavy Equipment Transporter System
HHC	Headquarters and Headquarters Company
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HQ	Headquarters
IAV	Interim Armored Vehicle
IBAS	Improved Bradley Acquisition System
IED	Improvised Explosive Device
IFF	Identification Friend/Foe
IFV	Infantry Fighting Vehicle
IMI	Israeli Military Industries
LRIP	Low Rate Initial Production
LSAA	Logistic Support Area Anaconda
LVOSS	Light Vehicle Obscuration Smoke System
MBT	Main Battle Tank
MCAP	Mine Clearance Armor Protection
MDT	Mine Detonation Trailer
MDV	Mine Detection Vehicle
MEXAS	Modular Expandable Armor System
MMPV	Medium Mine Protected Vehicle
MSR	Main Supply Route
ODS	Operation Desert Storm
PNS	Precision Navigation System
RDECOM	Research Development and Engineering Command
RISE	Reliability Improvement of Selected Equipment
RPG	Rocket-Propelled Grenade
SHORAD	Short Range Air Defense
SICP	Standard Integrated Command Post
SINCGARS	SINgle Channel Ground and Airborne Radio System
SLEP	Service Life Extension Program
SOCOM	Special Operations Command
SVBIED	Suicide Vehicle-Borne Improvised Explosive Device
SVML	Standard Vehicle-Mounted Launcher
SUAV	Small Unmanned Aerial Vehicle
TARADCOM	Tank Automotive Research and Development Command
TARDEC	Tank Automotive Research, Development and Engineering Center
T/MDV	Towing/Mine Detection Vehicle
TMMG	Turret-Mounted Machine Gun
TUAV	Tactical Unmanned Aerial Vehicle
UAV	Unmanned Aerial Vehicle
UGWS	Up-Gunned Weapon Station
USMC	United States Marine Corps
UXO	Unexploded Ordnance
VMS	Vehicle Monitor Sensor

Introduction

Between March and May 2003, U.S.-led Coalition Forces invaded Iraq to end the reign of Saddam Hussein and his ruthless regime. One reason for the Coalition's decisive and quick victory was the overwhelming strength and capabilities of the U.S. military machine, a force that is so well designed to fight and win a conventional war. During the initial assault on Iraq, some 140 U.S. troops were killed, while official sources claimed that some fifteen armored fighting vehicles like the M1A1 Abrams MBT or the M2A2ODS Bradley IFV were lost to hostile fire. In military terms, it could be said that this was an acceptable toll when taking into account the fact that the forces of a whole country were totally destroyed in the brief campaign.

But the fighting in Iraq had not yet finished. Even as President George W. Bush was announcing that the war was over, the situation in Iraq was swiftly transforming into a guerilla war. The Coalition Forces, the bulk of which were from the USA, were now fighting an enemy that easily blended with the local population - an enemy that could not be easily identified. The enemy consisted of former regime loyalist groups, foreign fighters from terrorist organizations such as Al-Qaeda, and Islamic fundamentalist groups that claimed to be fighting against the American crusaders. In the early days of this new asymmetric conflict, insurgent attacks targeted Coalition Forces. The tactics used were ambushes, mortar and rocket attacks, plus IEDs aimed at convoys. The insurgents were beaten most of the time whenever they confronted U.S. forces in open combat. On the other hand, new tactics and equipment being used by U.S. troops forced any successful attack on them to become more and more complicated. Insurgents changed their tactics in response to this, with IEDs becoming the weapon of choice. Placed on roadsides they targeted the supply chains of U.S. forces. In addition, the insurgents increasingly began to attack the new Iraqi Security Forces and any people volunteering to serve in them. The number of suicide attacks skyrocketed. With such suicide bombers, the Suicide Vehicle-Borne IED (SVBIED) became a major threat to Coalition Forces.

Coinciding with the development of the political process in Iraq, insurgents widened their target range yet again. Bombing civilians became a common practice and even mosques were targeted. The aim of this practice was to spread terror and to destroy any trust of the population in Iraqi and Coalition Forces, as well as to destabilize the country by fueling ethnic tensions. American forces reacted to insurgent aggression with countless operations. In November 2004, for example, U.S. Army and United States Marine Corps units stormed Fallujah. This insurgent stronghold had been a symbol of the resistance against the Coalition and the new Iraqi Government. Although it was well fortified, the city fell within two weeks, and U.S. troops again proved their superiority in open combat against a known enemy. Another major operation was conducted by the 3rd Armored Cavalry Regiment, which smashed insurgent activity in Tall Afar in August 2005. Since the beginning of the insurgency in May 2003, some 2,100 U.S. troops have been killed in Iraq, while another 16,600 have been wounded. Over 64% of these casualties were the result of IED attacks. In late 2005, some 160,000 U.S. troops were serving in Iraq.

When the Iraqi insurgency started in 2003, the U.S Army was not prepared for a bloody guerilla war. This is well illustrated by the fact that the U.S. Army lacked the necessary vehicles to fight an insurgency. When the Army entered Iraq, most of its vehicle fleet was still of the sort designed for conventional high-intensity conflicts. Combat units, which would invariably fight on the frontlines, featured heavy, armor-protected fighting vehicles that were able to engage an enemy at maximum ranges. There were no frontlines in Iraq, however, and troops that in the past might have been hundreds of kilometers from the fighting, suddenly found themselves in the middle of a brutal war. Being mostly logistic assets, these units could only field soft-skinned vehicles that lacked any sort of armor protection. This fact, which resulted in large numbers of casualties, led to a drop in morale and in at least one case, resulted in troops refusing to obey orders. As a result of this, CENTCOM issued a requirement for large quantities of armor-protected vehicles in October 2003. This set the Vehicle Hardening Program in motion, in which work began to harden some 38,000 vehicles ranging from HMMWVs to heavy trucks such as the HEMTT and HETS.

The hardening of these vehicles was conducted at three levels. Level III was done by units in the field using steel plates delivered and approved through the supply chain of the HQ of the Department of the Army. Not featuring any ballistic glass, this armor only provided basic protection against small-arms fire and smaller IED fragments. In Level II, Add-on Armor Kits were prefabricated and then sent to Iraq to be fitted onto the hulls of vehicles already deployed there. Some of the kits were specially developed, tested and manufactured by Army depots, while others were off-the-shelf solutions purchased from the defense industry. This armor provided protection against small-arms fire, IEDs and mines. Level I solutions saw the U.S. Army purchasing large quantities of vehicles that already possessed inherent armor, for example the M1114 Up-armored HMMWV, the M1117 Guardian ASV, or the FMTV with Low Signature Armored Cab. These vehicles provided the highest possible protection level against small-arms fire, mine blasts and IEDs. By late 2004, most vehicles deployed to Iraq featured some sort of Level III or Level II armor. At the same time, the delivery of vehicles in the Level I category was in full swing. At the time of writing in early 2006, large quantities of vehicles in the Level I category were replacing vehicles featuring Level III armor.

Separate from the vehicle-hardening program, kits to improve the capabilities of armored fighting vehicles were developed and produced, or purchased as packages. These included the Enhanced Reactive Armor for the M2/M3 Bradley, the Add-on Armor Suite for the M113A3, and the Tank Urban Survival Kit for the M1 Abrams MBT. To counter the IED and mine threat, the U.S. Army also introduced several vehicles with a high degree of blast protection, vehicles such as the Buffalo MP/CV or the Rhino Runner Bus.

The aim of this two-part Concord series is to provide an overview of the armored vehicles used by soldiers of the U.S. Army in Iraq. It must be mentioned that only armored fighting vehicles and armored vehicles with Level I or Level II armor are covered. This first book will look at variants of the M2 Bradley IFV and the M3 Bradley CFV, as well as the M6 Bradley Linebacker. Also covered are vehicles of the M113A3 family of vehicles, Caterpillar D7R and D9R bulldozers, armor-protected HMMWVs and the M1114 Up-armored HMMWV, the M1117 Guardian Armored Security Vehicle, the RG-31 Medium Mine Protected Vehicle, the Buffalo Mine Protected Clearance Vehicle, the Husky Towing/Mine Detection Vehicle, the Meerkat Mine Detection Vehicle, and the Rhino Runner Bus. While not really matching the title of this book, it was also thought appropriate to include some information on unmanned aerial vehicles. The U.S. Army was using this quite new method of reconnaissance and surveillance on a large scale for the first time in Iraq. Information on the Raven Small Unmanned Aerial Vehicle and the Shadow 200 Tactical Unmanned Aerial Vehicle is therefore presented in this volume.

The M2 Bradley IFV and the M3 Bradley CFV

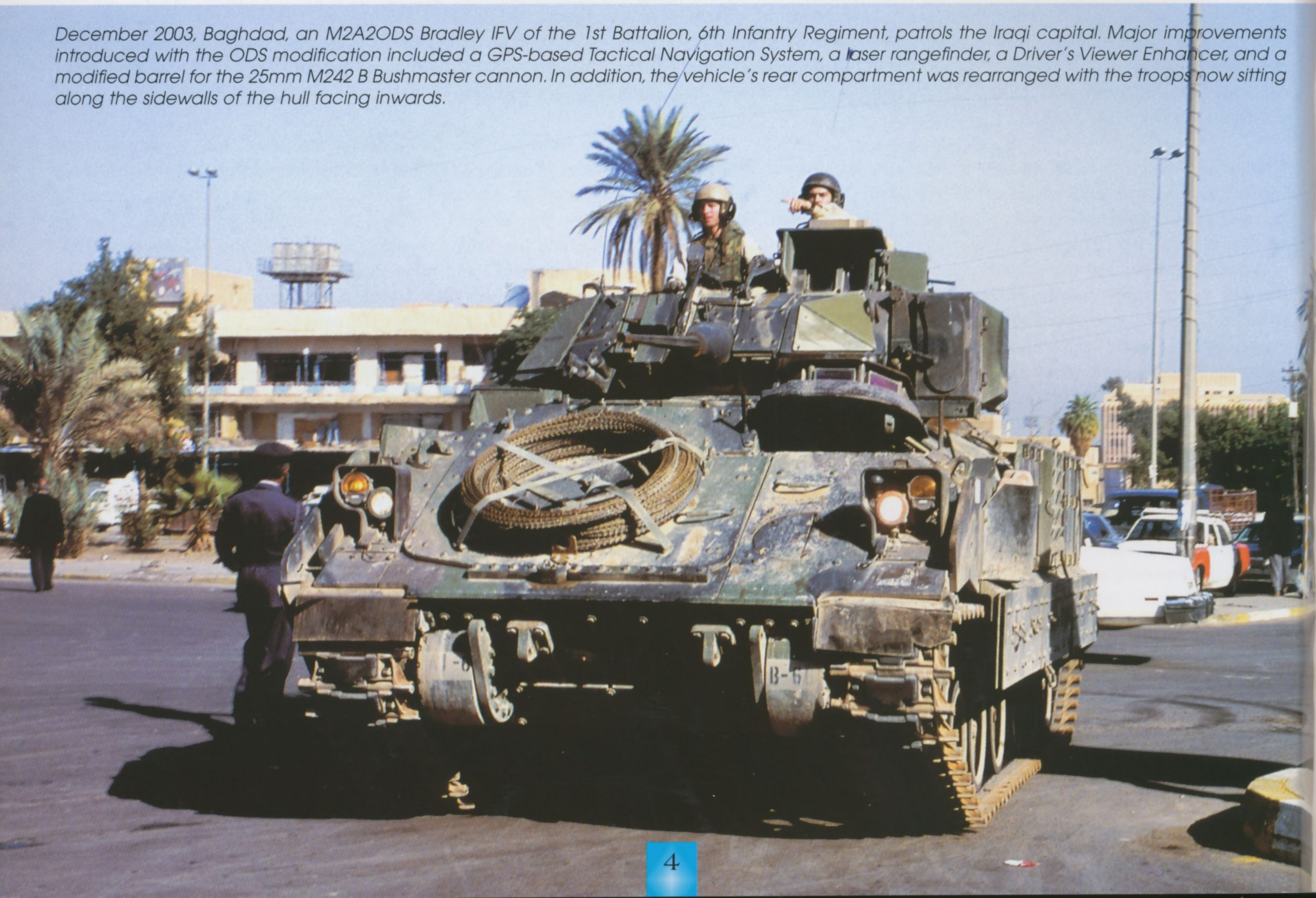
Since it first entered service with the U.S. Army in 1983, the M2 Bradley Infantry Fighting Vehicle has become the backbone of mechanized infantry units, while the M3 Bradley Cavalry Fighting Vehicle has become the primary reconnaissance platform of armored cavalry units. The M2 and M3 are almost identical. However, the M3 has only a crew of five, including two dismounts, while the M2 has a crew of three and carries some seven dismounts in the rear. The Bradley has gone through several improvement programs over the years. From 1986 onwards, the M2A1 and M3A1 entered service, and existing Bradleys were converted to this new standard. The A1s featured the new TOW 2 Antitank Guided Missile System. Meanwhile, the firing ports in the troop compartment of the M3A1 were removed and the large overhead hatch was fitted with four periscopes.

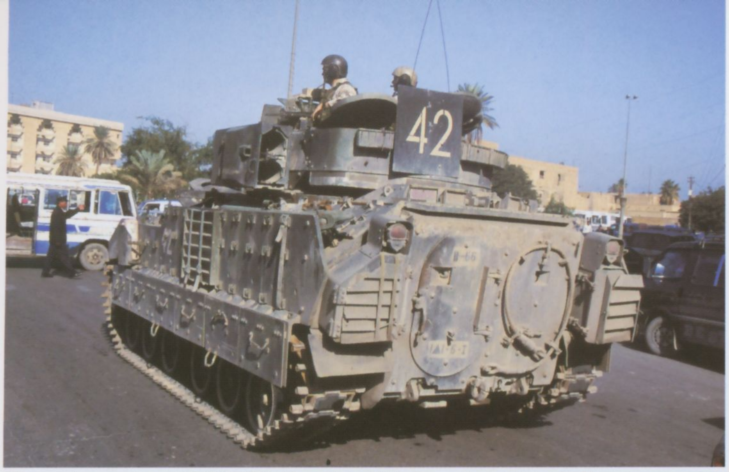
Then in 1988 the M2A2 and M3A2 entered service. For the first time the outer appearance of the Bradley changed drastically as new armor replaced the original all-welded aluminum armor combined with spaced laminated armor on the hull sides and rear. The original armor offered the vehicle basic protection against 14.5mm Armor Piercing (AP) rounds and splinters from 155mm High Explosive artillery shells. The M2A2 and the M3A2 were fitted with steel appliqué armor, and inside the vehicle a Kevlar spall liner was fitted. This armor protected the vehicle's crew from the effects of a direct hit from a 30mm AP round. Attachment points are also provided on the steel appliqué armor to fit another layer of passive armor in the form of an Explosive Reactive Armor kit. This new armor significantly increased the vehicle's weight and resulted in a decrease in mobility, as well as the loss of the vehicle's amphibious capabilities. In order to restore its performance, the M2A2 and M3A2 Bradley were fitted with a new engine, the 608hp Cummins VTA-903T. It was a mixed fleet of some 2,200 M2A1, M3A1, M2A2 and M3A2 vehicles that saw combat during the 1991 Gulf War. It was the first time that the Bradley entered combat, and it certainly proved its value in the hundred hours of the ground war. Crews claimed the weapon systems and optics of the vehicle were very effective and operational readiness rates during Operation Desert Storm were stated by official sources as being over 90%.

Despite its success during Operation Desert Storm, the U.S. Army saw the need to initiate the Bradley Modernization Plan (BMP). The BMP included the upgrade of older Bradleys to A2 standard and the upgrading of existing M2A2 and M3A2 to "Operation Desert Storm" standard. With the ODS improvements, the Bradley was fitted with a GPS-based Tactical Navigation System, a laser rangefinder, a modified barrel for the 25mm M242 B Bushmaster cannon, and a Driver's Viewer Enhancer. In addition, the vehicle's rear troop compartment was rearranged - whereas before the dismounts sat facing outwards, now they sat along the sides of the hull facing inwards. The modified Bradleys were subsequently named M2A2ODS IFV and M3A2ODS CFV. Together with the A2, the A2ODS saw operational service in Bosnia from 1996 on, and in Kosovo from 1999 onwards.

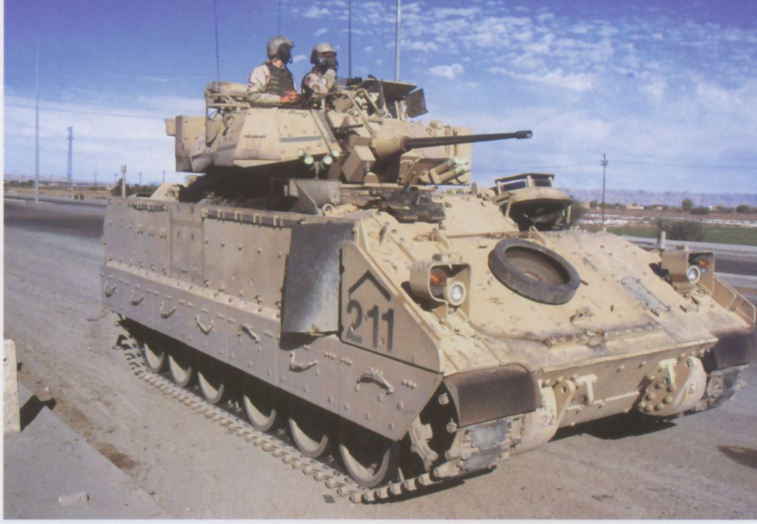
Also part of the BMP was the development of an upgraded Bradley A3. The development target for the A3 was an IFV/CFV that could overcome the perceived threats of a future battlefield. United Defense LP was awarded an engineering and development contract in early 1994, under which eight prototypes were built and tested. A Low Rate Initial Production (LRIP) contract for thirty-five M2A3s was signed in June 1997 and production started a month later. After several smaller orders in 2001, the M2A3 was approved for full-rate production. In May 2000 the first unit to be equipped with the M2A3 Bradley was the 2nd Battalion, 8th Infantry Regiment, of the 4th Infantry Division at Fort Hood, Texas. Like the M2, the M3 Cavalry Fighting Vehicle will also be upgraded to A3 standard, and the upgrades will be similar to those incorporated in the M2A3.

December 2003, Baghdad, an M2A2ODS Bradley IFV of the 1st Battalion, 6th Infantry Regiment, patrols the Iraqi capital. Major improvements introduced with the ODS modification included a GPS-based Tactical Navigation System, a laser rangefinder, a Driver's Viewer Enhancer, and a modified barrel for the 25mm M242 B Bushmaster cannon. In addition, the vehicle's rear compartment was rearranged with the troops now sitting along the sidewalls of the hull facing inwards.





Rear view of a M2A2ODS Bradley IFV. Clearly visible is the large rear ramp, which is power operated and is used by the dismounts to enter or leave the vehicle. Note the IFF panels on the vehicle side and rear. The panels were first used by the U.S. Army in operations in Bosnia 1996. The vehicles of units that deployed from Europe to Iraq were still painted in the standard three-tone camouflage of green, brown and black.



This M2A2ODS Bradley IFV belongs to the 1st Battalion, 22nd Infantry Regiment, of the 4th Infantry Division. In December 2003 the Bradleys of the unit operated in the Bayji region. Not yet fitted with ERA, the vehicle provides a nice view of the steel appliqué armor first fitted with the A2 modification.

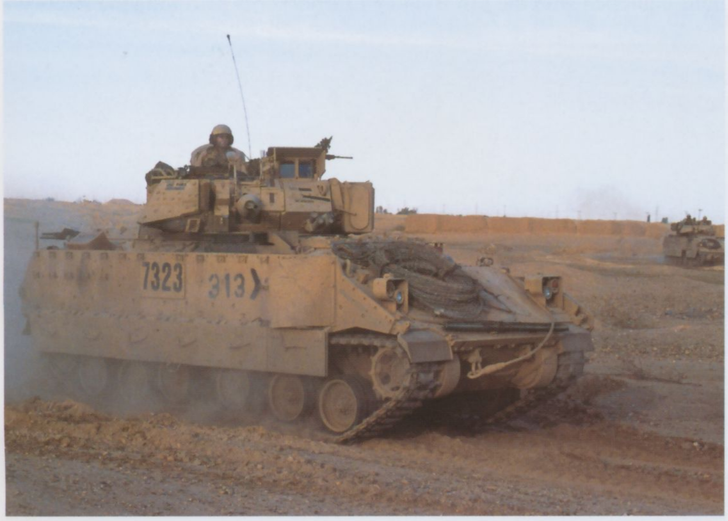
A3 modifications

The A3 modifications improved the Bradley's lethality, survivability, sustainability and mobility. In addition, the vehicle's command and control system was upgraded. In terms of lethality, the M2A3 Bradley was fitted with the Improved Bradley Acquisition System. IBAS integrates all the weapon optics and controls of the commander and gunner. The systems connected to IBAS include an HTI second-generation FLIR system, an eye-safe laser rangefinder, an automatic gun target adjustment system, an aided dual-target tracking system, a day TV camera, and the Commander's Independent Viewer. IBAS increased the target detection range by 56% for daytime operations and by 78% for nighttime operations. Once a target has been detected, the identification capability was increased by 70% in daylight and 232% at night. Additionally, the A3 Bradley turret crew now has a hunter-killer capability with IBAS. The TOW missile launcher, the gyro-stabilized 25mm Bushmaster cannon and the 7.62mm M240B machine gun are all integrated with IBAS. The A3 Bradley (and therefore IBAS) uses a MIL-STD 1553 databus as its central processor unit.

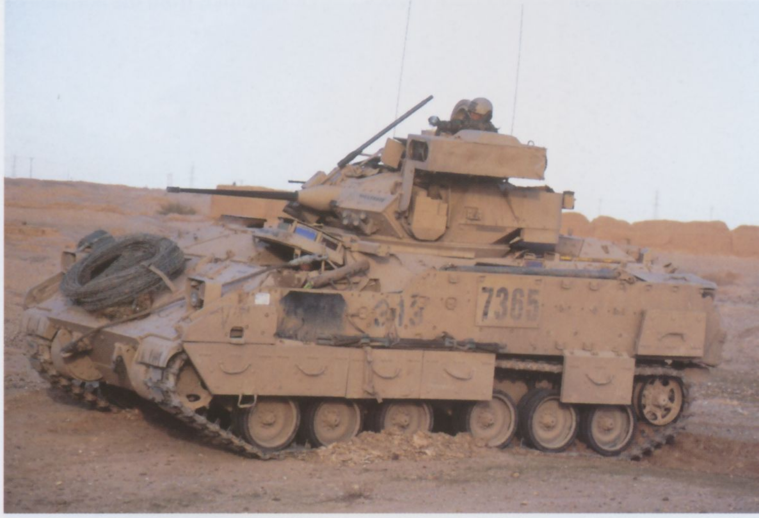
The only major visible modification of the A3 Bradley that can be identified from the outside is the Commander's Independent Viewer. Situated to the rear right of the turret, the CIV combines an HTI second-generation FLIR and day TV camera, and provides the commander with an independent observation and target acquisition source. The optics of the CIV allows the detection of targets at a range of up to seven kilometers, and the system can be rotated 360°. If the commander has detected a target that might be of urgent importance, he can use his override function and pass the target to the gunner by the simple press of a button. In such a case, the turret automatically swings round and the sights and gun are laid onto the new target.

For better command and control, the commander, gunner, driver, and even the squad commander in the rear fighting compartment, have access to Force XXI Battle Command, Brigade and Below consoles. With FCBC2 maps of the area, both friendly forces and known enemy units can be displayed. With this system it is also possible to pass text messages or transmit the logistical status of vehicles and units. The squad leader in the rear compartment is equipped with the Squad Tactical Display, a unit that allows him to see the pictures provided by the FLIR, day TV camera and CIV. The squad leader also has access to the FCBC2 via the Squad Tactical Display. Thus the squad leader and his troops can paint a fairly complete picture of the situation they will encounter once they dismount.

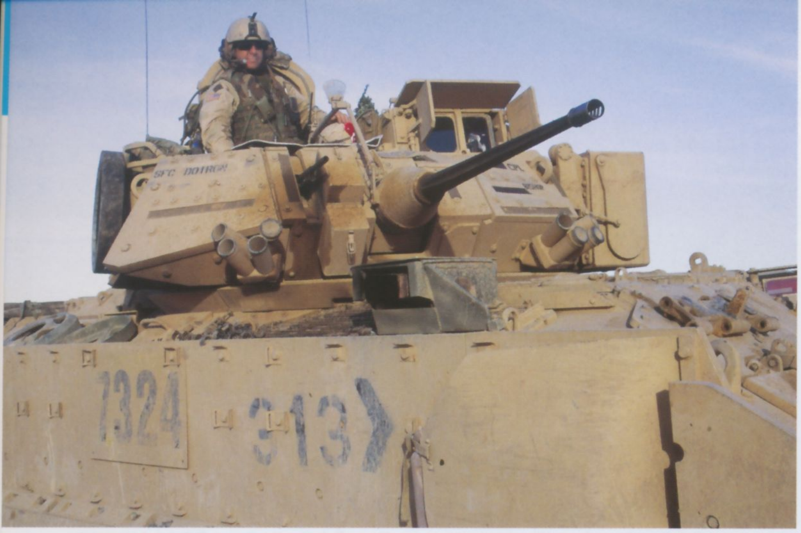
By providing the driver with new night vision equipment and navigation aids, the mobility of the A3 Bradley has been increased. Like the A2ODS



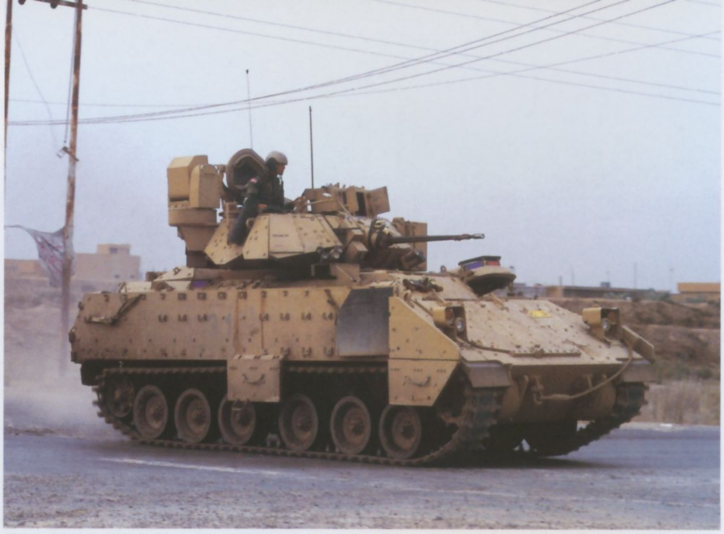
M2A2ODS Bradley IFVs operate on the outskirts of Samarra in December 2003. The vehicles belong to C Company, 1st Battalion, 8th Infantry Regiment. The Cummins VTA-903T engine of the M2A2ODS develops 608hp, allowing the vehicle to reach a top speed of over 60km/h. Like all vehicles of the 4th Infantry Division (based at Fort Hood, Texas), they are painted in standard U.S. Army desert camouflage.



Another picture of an M2A2ODS Bradley IFV of the 1st Battalion, 8th Infantry Regiment. Note the wire cutter mounted on the turret, a device made at the unit level, and designed to prevent the crew from being struck by low-hanging telephone or power lines. The crew has the vehicle's TOW launcher raised to the firing position. In the launcher are two firing tubes. The TOW is able to destroy any known armor out to a distance of 3,750m.



The M2A2ODS Bradley IFV is fitted with a modified barrel for the 25mm M242 Bushmaster cannon. The new barrel allows better heat transfer and therefore prevents overheating during firing in hot climates. The 25mm Bushmaster cannon has a dual-feed capability that can be selected by the gunner. Either 100 or 200 rounds a minute can be fired. A total of 300 rounds for the cannon are stowed in the ready position when the vehicle is in action. A reserve of 600 additional rounds is stored inside the vehicle. The two small boxes between the M242 Bushmaster cannon barrel and the coaxial 7.62mm M240C machine gun are designed for storing spare smoke grenades for the smoke dischargers.



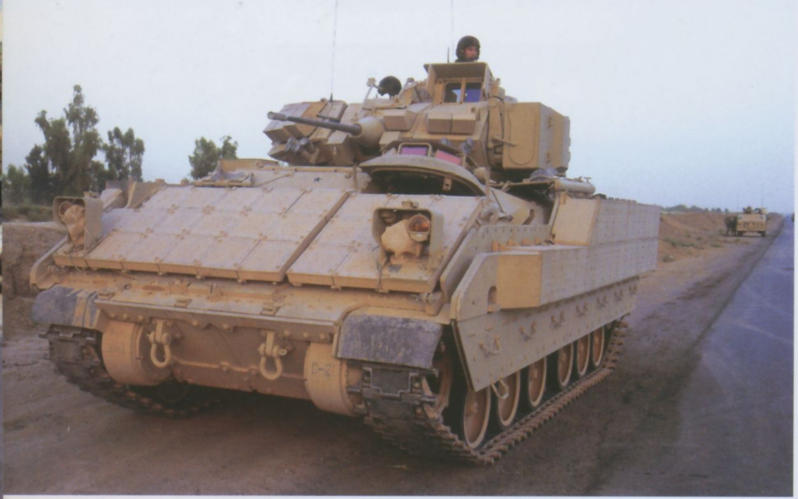
The first M2A3 Bradley IFVs were deployed to Iraq with units of the 4th Infantry Division. Here one of these vehicles can be seen thundering down a road on the outskirts of Baqubah in December 2003. Visible is the CIV behind the commander's cupola. Note the large number of missing segments of the armored side skirts.

Bradley, the A3 is equipped with the Driver's Vision Enhancer, which allows the driver to operate the vehicle in total darkness. A Precision Navigation System that incorporates a GPS, a Vehicle Monitor Sensor and an Inertial Navigation Unit, helps the driver to find his way. Position coordinates are shown on a display screen, and when waypoints are entered into the system, the PNS calculates steering directions, azimuth, and range information to help reach the destination. Sustainability of the A3 is enhanced by the integration of digital built-in test equipment and a digital logistic reporting system. Maintenance is simplified owing to the fact that the Direct Support Electronic Test Set can be used with the M2A3 Bradley. The A3 is also compatible with the Soldiers' Portable On-system Repair Tool. In the area of survivability, the turret roof of the A3 Bradley is fitted with new titanium armor.

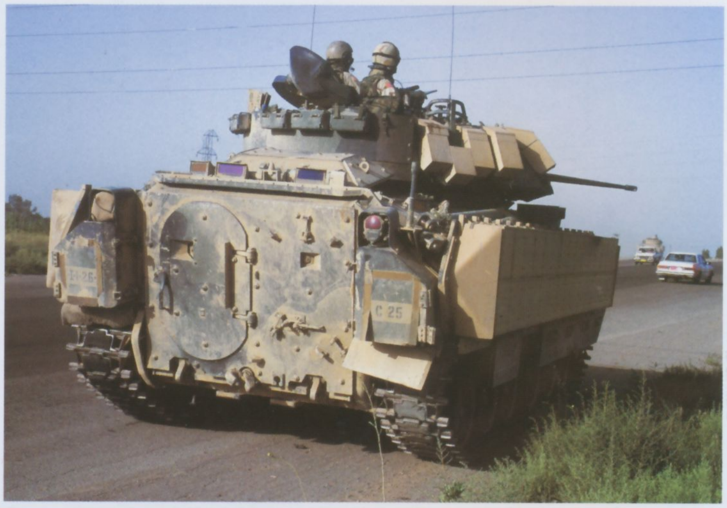
The A3 Bradley is the first infantry fighting vehicle to be technologically equal to the M1A2 SEP Abrams MBT. This fact allows better cooperation between tanks and mechanized infantry within a combined arms team. During Operation Iraqi Freedom, U.S. troops benefited from the abilities of the M2A3 Bradley since the vehicle's 25mm Bushmaster cannon was much better suited to the task of taking out insurgent positions in built-up areas than was the 120mm main gun of the M1A2 SEP Abrams. The main armament of the Bradley can now be used effectively with the same technological advantages found in the M1A2 SEP.

Other Bradley variants operating in Iraq

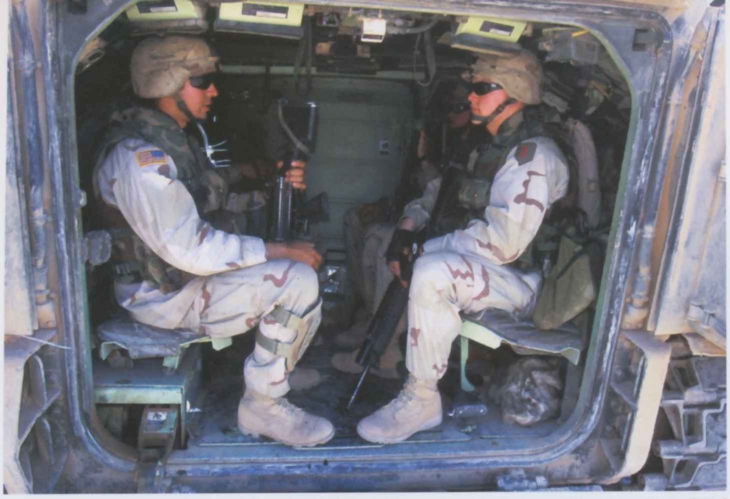
The M6 Bradley Linebacker Short Range Air Defense System is basically an M2A2 that has been fitted with four Stinger Surface-to-Air Missiles mounted in a Standard Vehicle-Mounted Launcher, instead of the usual TOW launcher. The Stinger fire control system, the Slew-to-Cue system, and the Sentinel Radar target acquisition system are all mounted in the turret of the M6 Bradley Linebacker. The first M6 Bradley Linebacker entered service with division-level air defense units of the U.S. Army in 1997. During the initial phase of Operation Iraqi Freedom, M6 Bradley Linebackers provided short-range air defense against any possible incursions by Iraqi aircraft, a threat that never materialized. When the fighting turned into a bloody guerilla war in the summer of 2003, air defense units were instead tasked with basic infantry missions. This was possible due to the fact that the M6 Bradley Linebacker, in addition to its Stinger launcher, is still equipped with a 25mm M242 Bushmaster cannon and coaxial 7.62mm M240C machine gun. One task commonly given to units equipped with the M6 Bradley Linebacker is patrolling the infamous



In the summer of 2004, most Bradleys operating in Iraq, like this M2A2 Bradley IFV, were already fitted with ERA in order to protect them from the deadly effects of RPG-7 warheads. The ERA kit for the Bradley consists of 105 box-shaped armor tiles in five different sizes. The pictured vehicle belongs to C Company, 1st Battalion, 26th Infantry Regiment, and was seen during a patrol near Balad.



Rear view of an M2A2ODS Bradley IFV fitted with ERA, belonging to the 1st Battalion, 26th Infantry Regiment. In May 2004 the unit operated a mixed fleet of M2A2 and M2A2ODS. While the vehicle is painted in the standard three-tone camouflage pattern, the ERA kit is painted in desert camouflage paint. Note the Tactical Navigation System antenna mounted at the rear on the right side of the vehicle.


The rear troop compartment of the Bradley was modified in the ODS version, with the troops now sitting along the hull sides facing inwards. The M2A2ODS Bradley IFV offers space for up to seven fully equipped troops, three of which are seated on the right and four on the left.

road that links Baghdad International Airport with the Green Zone. For a long period this route was the most dangerous road in the whole of Iraq, with incidents such as ambushes and IED attacks taking place several times a day. It is also believed that a couple of M7 Bradley Fire Support Vehicles (BFIST) is in action in Iraq with field artillery units. They are fitted with a Targeting Station Control Panel and a Mission Processing Unit.

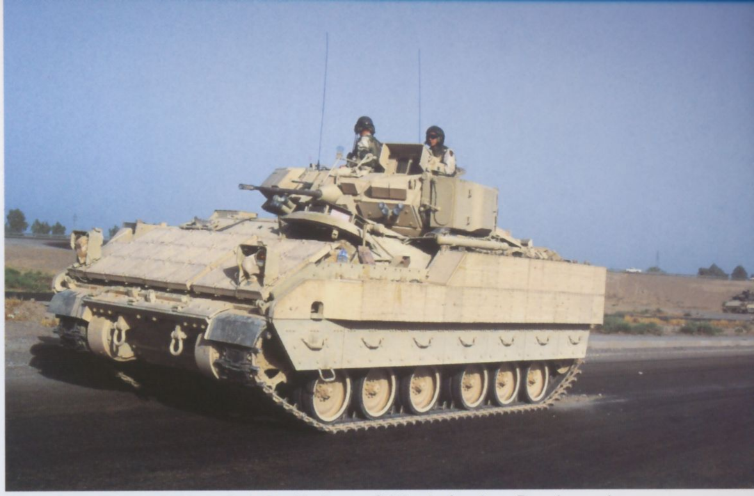
Operating in Iraq

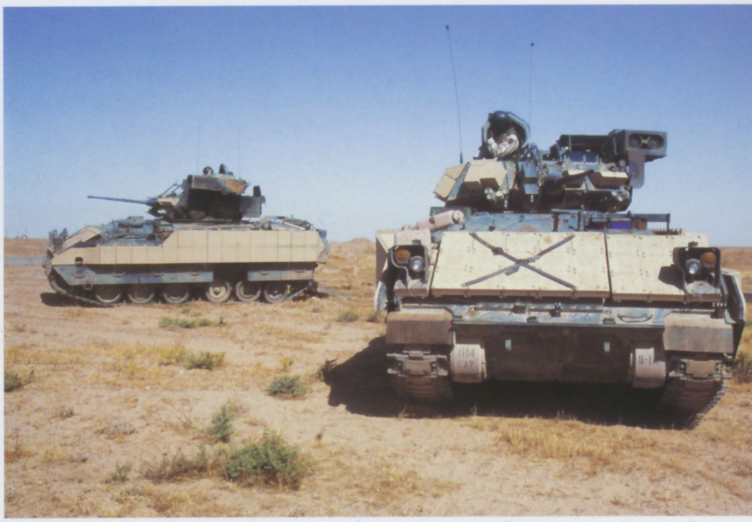
The first formation to deploy to Iraq with the new M2A3 Bradley was the 4th Infantry Division in 2003. In 2004 the 1st Cavalry Division, with some of its units already equipped with the M2A3, took over the Baghdad region as its AOO. However, by late 2005 (over two and a half years after the beginning of Operation Iraqi Freedom) the bulk of the mechanized infantry of the U.S. Army in Iraq were operating the M2A2ODS, while reconnaissance elements were fielding the M3A2ODS. On the other hand, countless M2A2 and M3A2 vehicles continued to see action in Iraq. These vehicles belonged either to units not yet equipped with newer models of the Bradley, or were replacements for vehicles lost in combat. Therefore, it is quite common to see units operating a mixed fleet of Bradley versions.

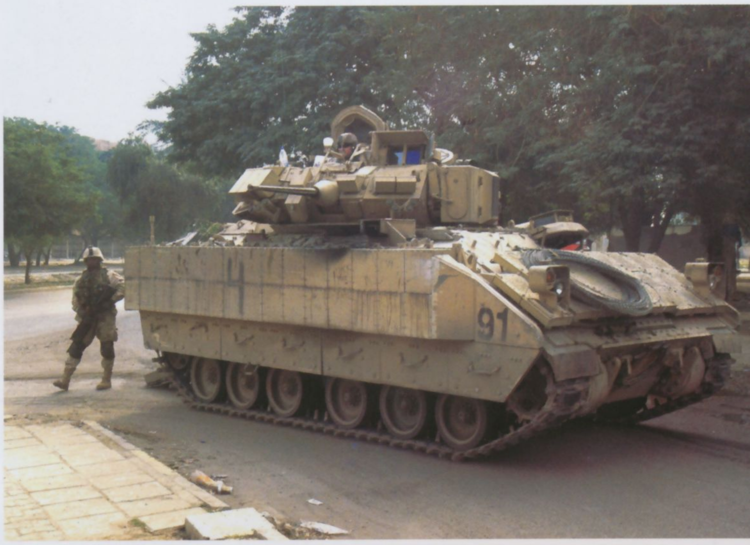
Modifications for urban operations

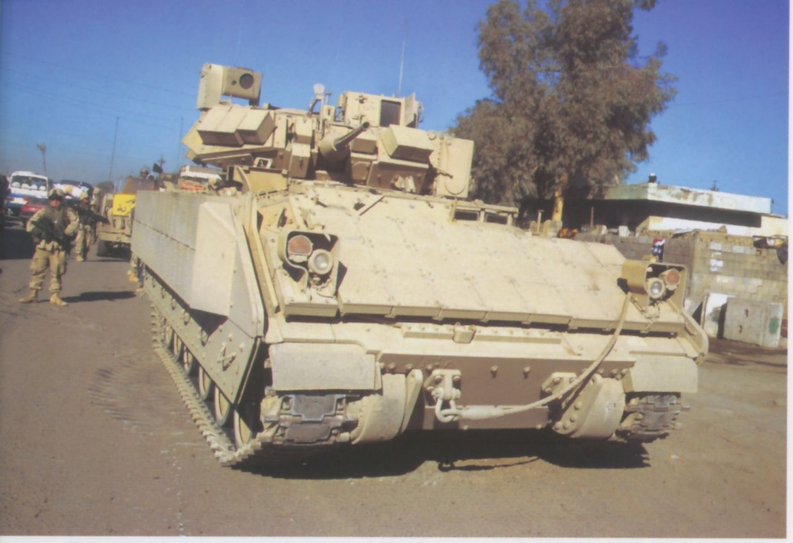
At the time of writing, the U.S. Army was working on additional improvements to the M2A2ODS IFV and the M2A3 CFV in order to make the vehicles more capable in urban operations. The Commander's Light Automatic Weapon CIV Attachment will see a 5.56mm M249 machine gun mounted coaxially with the CIV of the M2A3. In the case of the M2A2ODS, a skate mount will be bolted to the turret around the commander's cupola. An M249 or M240B machine gun can be mounted on this using the M1 Loader's Weapon Mount, along with the Transparent Armored Gun Shield. Additional protection for the commander is provided by the Armored Commander's Station, which features transparent armor and runs around the front of the commander's cupola. With the Integrated Sight Unit Protection, the vehicle's sophisticated sighting equipment is protected against small projectiles such as stones. This protective unit is formed from wire-mesh grills. A triangular Power Line Protection fitting will prevent turret crews from being tangled up by low-hanging power or telephone lines. Also planned is a roof-mounted spotlight in order to provide the vehicle commander with a light source for search operations.

A short barrel for the 25mm M242 cannon will allow easier 360° operation of the weapon in narrow streets and minimize the danger of hitting walls or other objects. In conjunction with the new barrel, new 25mm Urban Ammunition will be introduced that will have a bigger impact on structures. Mounted on the front of the Bradley will be a new Combat Bumper that allows barricades to be pushed out of the way, or building walls to be knocked down. The bumper will be spaced from the vehicle in order to prevent falling debris from contacting the vehicle structure. Mounted along with the bumper will be a tow cable assembly that allows the quick recovery of damaged vehicles. To improve the Bradley's armor

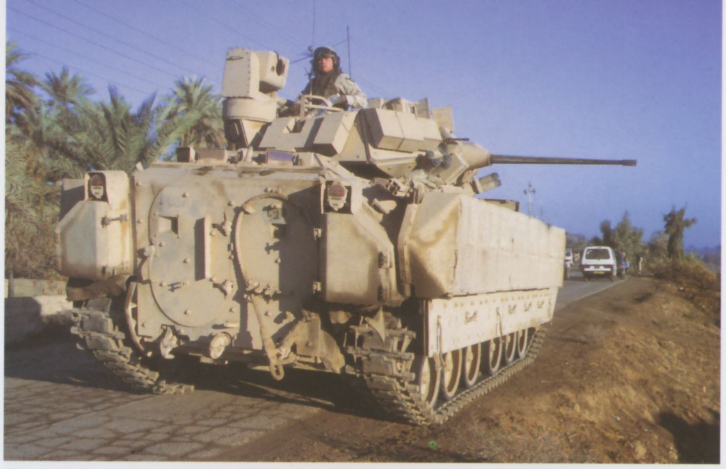

Bradley IFVs of the 1st Battalion, 26th Infantry Regiment, are seen conducting an IED sweep on MSR Tampa. The vehicle in the foreground is an M2A2, while the vehicle in the far distance is an M2A2ODS. In evidence are the different types of armor tiles of the ERA kit. The left side of the Bradley hull is protected by twenty-five M5A1 tiles, while twenty-six M3A1 tiles are mounted on the glacis plate.


Belonging to the 1st Squadron, 4th Cavalry Regiment, these two M3A2ODS Bradley CFVs were seen north of Bayji in June 2004. Both vehicles are fitted with the ERA kit. The CFV and IFV are nearly identical, but one of the major differences between the two is that the CFV carries only two dismounts in its rear troop compartment.


This M2A2ODS Bradley IFV belongs to the 1st Battalion, 9th Cavalry Regiment, which is a mechanized infantry unit of the 1st Cavalry Division. This vehicle was seen on patrol in central Baghdad in December 2004. While most other units of the division had already received the new M2A3, 1-9CAV went into battle with the older Bradley version.



The M2A3 Bradley is the most modern version of the IFV used by the U.S. Army. This vehicle belongs to the 2nd Battalion, 5th Cavalry Regiment, and was seen in Sadr City, Baghdad, in December 2004. The vehicle is armed with a 25mm Bushmaster M242 cannon, a coaxial 7.62mm M240C machine gun, and a twin-tube TOW launcher.



Rear view of an M2A3 Bradley IFV of the 2nd Battalion, 7th Cavalry Regiment. In full view is the CIV mounted behind the commander's cupola. Situated at the right and rear of the turret, the CIV combines an HTI second-generation FLIR and day TV camera, and it provides the commander with an independent observation and target acquisition source. The optics of the CIV allows detection of targets out to a range of seven kilometers and the system can be rotated 360°.

protection against RPG warheads, the vehicle skirts and rear will be fitted with bar armor. Additional mine and IED protection will be provided by the addition of Underbelly Armor, as well as Horizontal and Vertical Sponson Armor.

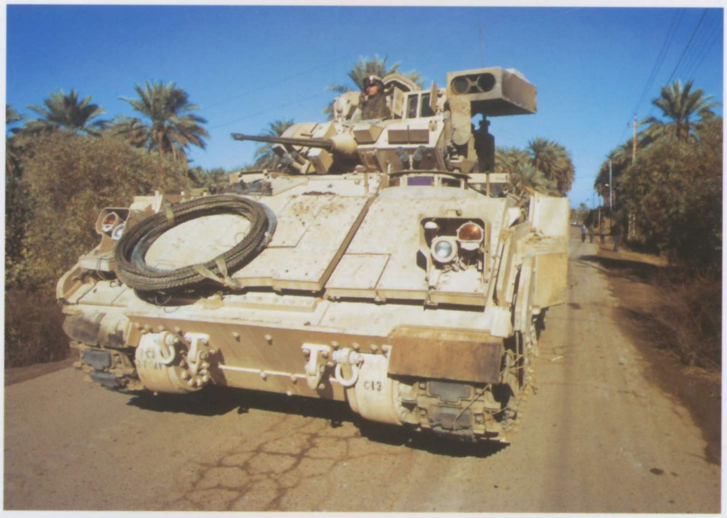
Explosive Reactive Armor Kit

The Explosive Reactive Armor kit for the Bradley consists of 105 box-shaped armor tiles in five different shapes. The tiles are bolted onto rails mounted on the vehicle's hull front and sides, as well as onto the front and right side of the turret. The rails are screwed onto the mounting points of the steel appliqué armor. A complete ERA Kit is formed from the following tiles:

M3A1 (flat square tile - 26 tiles for the vehicle's front glacis plate)
M4A1 (small beveled tile - 9 for the vehicle's front glacis plate)
M5A1 (square box-shaped tile - 55 for the vehicle's hull sides)
M6A1 (square box-shaped tile - 7 for the turret front and right side)
M7A1 (beveled tile - 8 for the turret front and right side)

The ERA kit can be fitted to most Bradley variants currently in service - including the M2A2, the M2A2ODS, the M2A3, the M3A2ODS, the M3A2, the M3A3, the M6 Linebacker and the M7 Bradley FIST. The tiles, which look like small boxes, contain a special explosive charge that detonates when hit by a missile or rocket with a shaped-charge warhead. The resulting explosion disrupts the incoming, armor-penetrating gas jet (produced by an RPG warhead, for example) so that the Bradley remains unharmed. The ERA kit provides the vehicle with increased battlefield survivability and adds a significant improvement to the Bradley's capacity to withstand a direct hit from a range of anti-armor munitions. Fitting of the ERA kit is done at the unit level, and a vehicle crew can fit the kit within a day. Fitting is done with the tools already available in the Bradley's tool kit and the tool kit of the battalion's maintenance element; no special tools are required. When the ERA kit is mounted on an M2A2ODS Bradley IFV, the vehicle has a combat weight of 32,695kg. The vehicle width is increased from 3.28m to 3.61m, a difference of 330mm. The ERA kit was jointly developed and produced by General Dynamics Armament and Technical Products (now BAE Systems) and RAFAEL of Israel. Development of the ERA started back in 1993 and the U.S. Army ordered the first batch of 175 ERA kits in 1995. By 2004 the U.S. Army's TACOM/ARDEC had purchased 465 complete and 170 partial ERA kits.

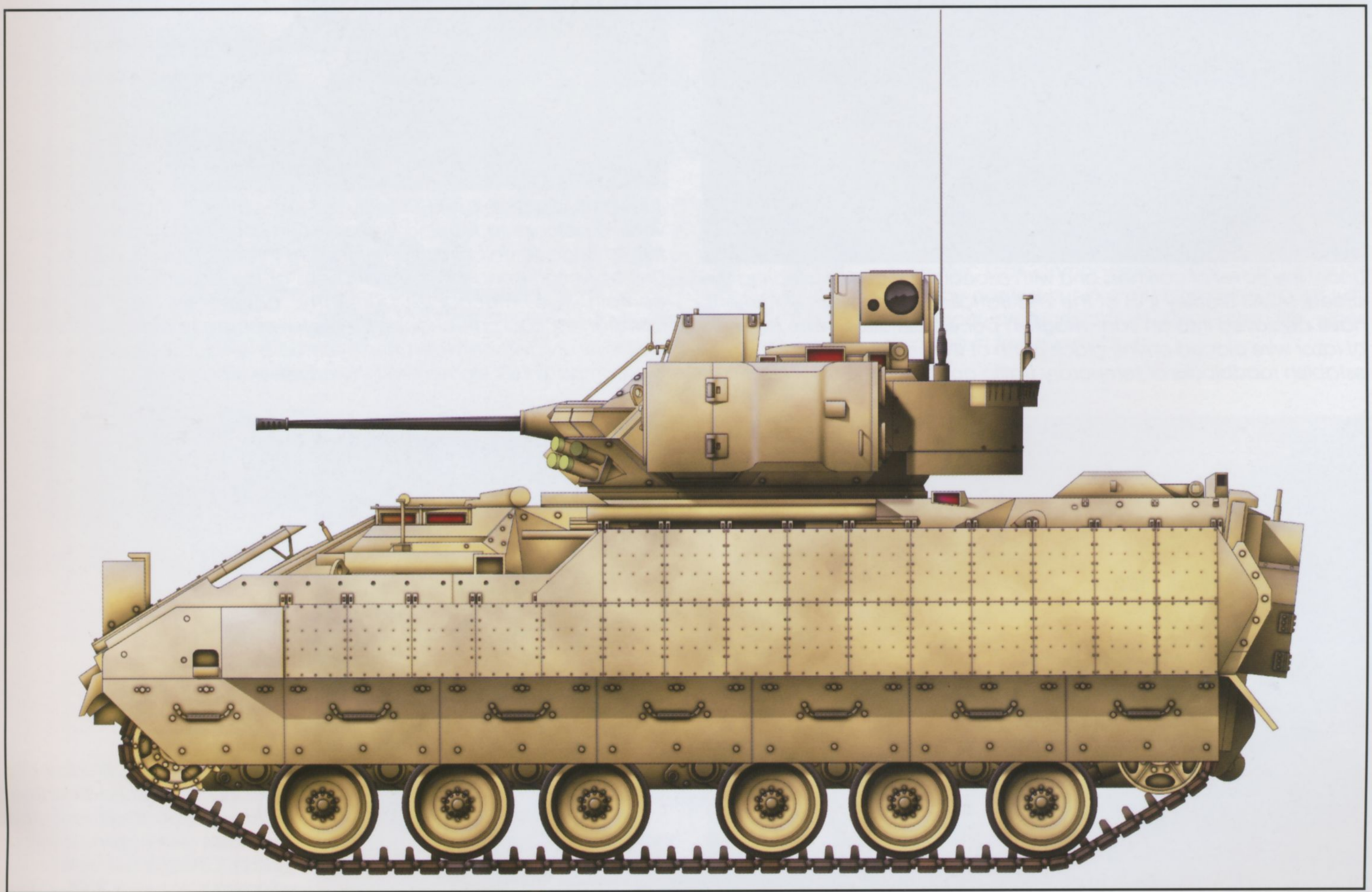
The 1st Cavalry Division was the second formation in the U.S. Army to receive the new M2A3 Bradley IFV. In 2004, when they deployed to Iraq, infantry units of the division had the privilege of riding into battle in the new vehicle. This M2A3 Bradley IFV belonging to the 2nd Battalion, 7th Cavalry Regiment, was seen somewhere north of Baghdad in December 2004.



The M2A3 Bradley IFV entered service with the U.S. Army in 1997. The Operation Iraqi Freedom deployment of the vehicle marked its combat debut. Here an M2A3 Bradley IFV of the 2nd Battalion, 7th Cavalry Regiment, can be seen during a combat operation north of Taji. Note the raised TOW launcher. While the M2A3 Bradley IFV performs outstandingly well in Iraq, the fact should not be overlooked that several vehicles have been lost to enemy fire so far. In most cases the vehicles had been evacuated by their crews and caught fire after a mobility kill.

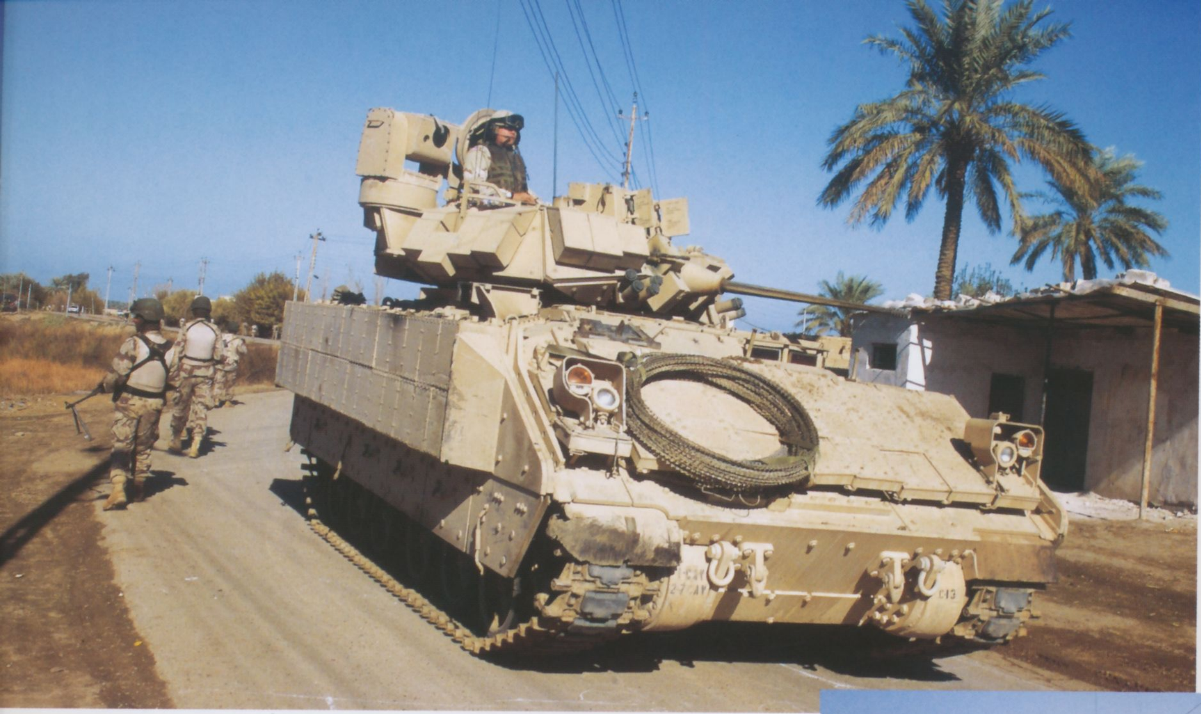
Technical Data for M2A3 Bradley IFV

Combat weight:	29,030kg without ERA, and 32,659kg with ERA
Crew:	3+7 dismounts
Width:	3.28m without ERA, and 3.61m with ERA
Length:	6.55m
Height:	3.38m (to top of CIV)
Maximum speed:	61km/h
Road range:	400km
Fuel tank capacity:	662 liters
Turning radius:	Pivot to infinite
Slope:	60%
Side slope:	40%
Trench crossing:	2.54m
Vertical wall climbing:	910mm
Engine:	Cummins VTA-903T diesel developing 608hp
Transmission:	HMPT-500-3EC hydro-mechanical, automatic, electronically controlled.
Suspension:	Torsion bar and return roller
Armament:	25mm M242 Bushmaster cannon, M240C 7.62mm coaxial machine gun, and TOW missile launcher with two tubes
Ammunition:	5 TOW missiles, 4,400 rounds of 7.62mm ammunition, and 900 rounds of 25mm ammunition.
Turret traverse:	360° continuous
Elevation:	+60° to –10° (25mm cannon and 7.62mm machine gun) +30° to –20° (TOW missile launcher)
Other Systems:	Halon fixed fire extinguisher systems in engine bay and personnel compartment, gas particulate filter unit, Improved Bradley Acquisition System (IBAS), Driver's Viewer Enhancer (DVE and AN/VVS-2), Enhanced Position Location Reporting System (EPLRS), Force XXI Battle Command, Brigade and Below (FBCB2), Single Channel Ground and Airborne Radio System (SINCGARS), Vehicular Intercommunication System (VIS), and Commander's Independent Viewer (CIV).

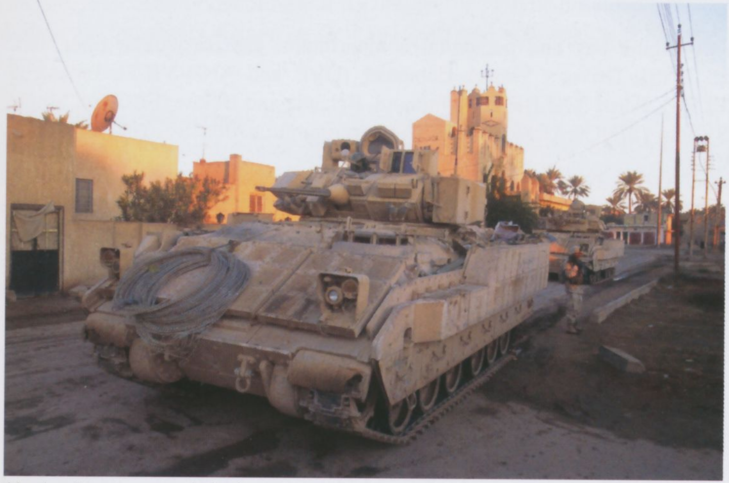


M2A3 Bradley, 2nd Battalion, 7th Cavalry Regiment, 1st Cavalry Division, north of Baghdad, December 2004

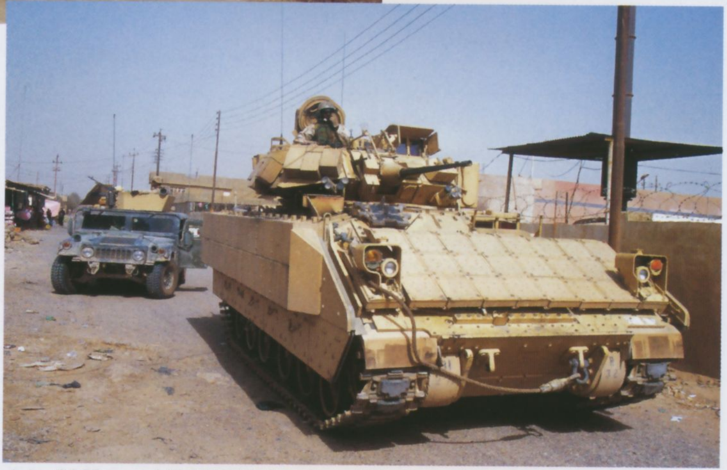
The conflict in Iraq marked the combat debut of the most modern version of the Bradley Infantry Fighting Vehicle, the M2A3 Bradley IFV. Like earlier Bradley versions operating in Iraq, most M2A3 Bradley IFVs were fitted with the ERA add-on armor kit. Among the new features of the M2A3 Bradley IFV is the Commander's Independent Viewer mounted on the turret. This M2A3 Bradley IFV belongs to a unit of the 1st Cavalry Division and operated in Iraq in December 2004.



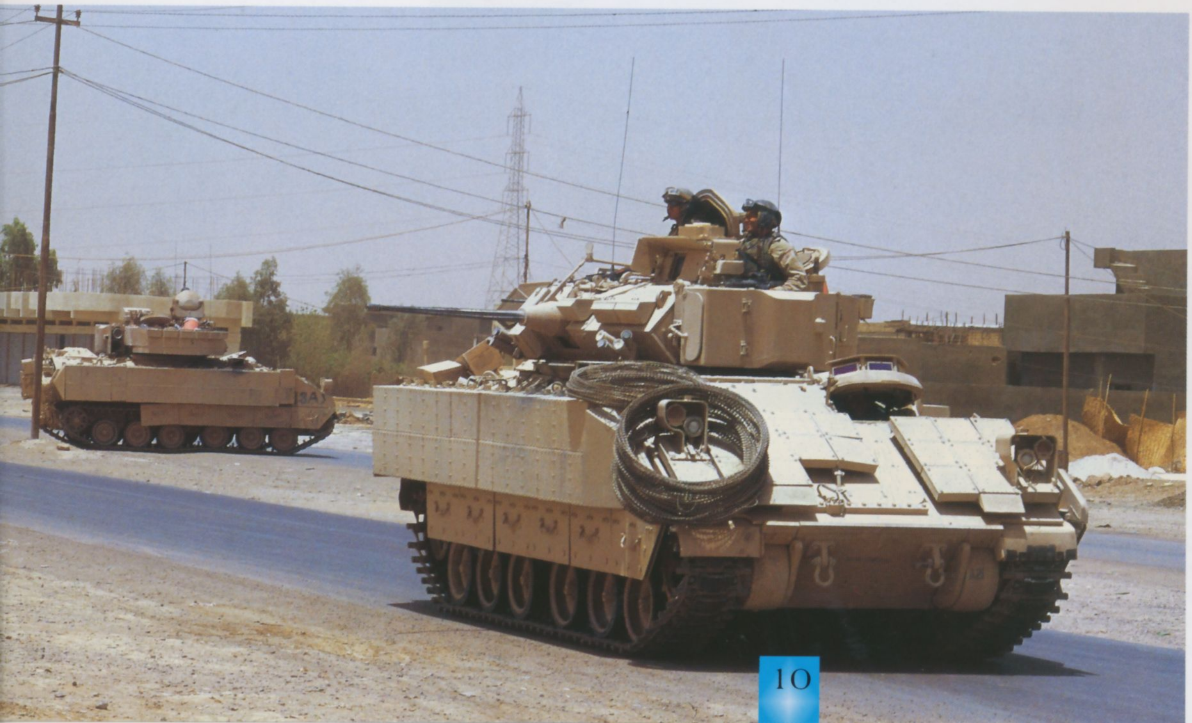
Like earlier Bradley versions operating in Iraq, most M2A3 Bradley IFVs are fitted with the ERA kit. The kit adds some 3,600kg to the combat weight of the vehicle and extends the width of the vehicle from 3.28m to 3.61m. This M2A3 Bradley IFV belongs to the 2nd Battalion, 7th Cavalry Regiment, and was seen during a joint operation involving U.S. and Iraqi forces in the Taji region in December 2004.



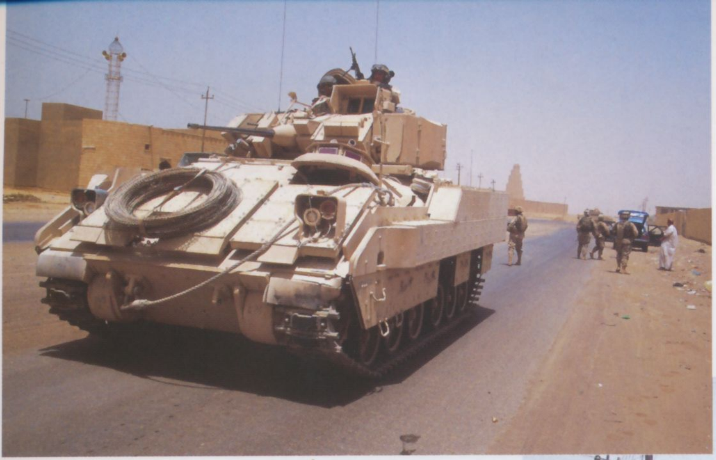
Under the cover of darkness and with a local night curfew clearing the streets, M2A3 Bradley IFVs of the 2nd Battalion, 7th Cavalry Regiment, have deployed into an Iraqi village in December 2004. Note the coils of razor wire placed on the glacis plate of the vehicle, ready for use to establish roadblocks or temporary traffic control posts.



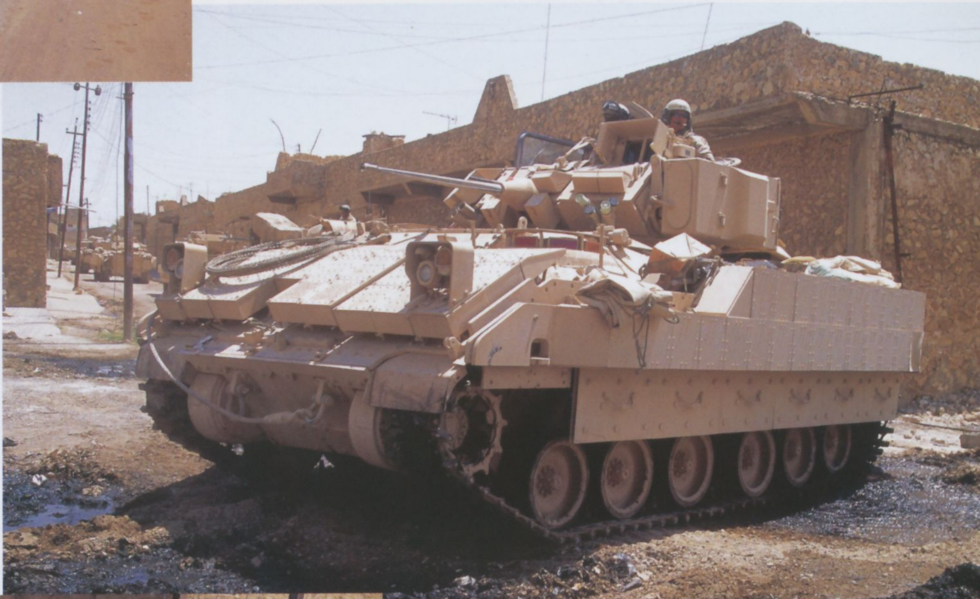
July 2005, an M2A2ODS Bradley IFV on patrol in southern Tikrit. The vehicle belongs to the 2nd Battalion, 7th Infantry Regiment - a unit of the 1st Brigade Unit of Action of the 3rd Infantry Division. With the new Unit of Action concept, the battalions of the brigade are mixed and contain two mechanized infantry companies and two tank companies. Each mechanized infantry company can field fourteen Bradleys, divided between three platoons of four vehicles each, and the company HQ element with two further Bradleys.



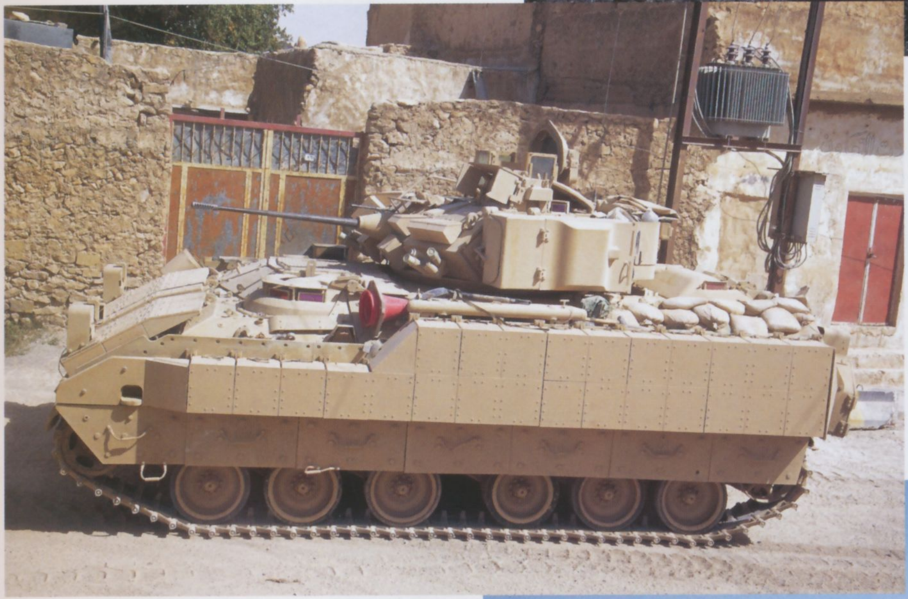
These M2A2ODS Bradley IFVs belong to the 3rd Battalion, 69th Armor Regiment. The vehicles were seen during a Flash Checkpoint mission in Samarra in July 2005. Using their 25mm M242 Bushmaster cannons, the vehicles provide protection for dismounted troops that are checking a nearby car.



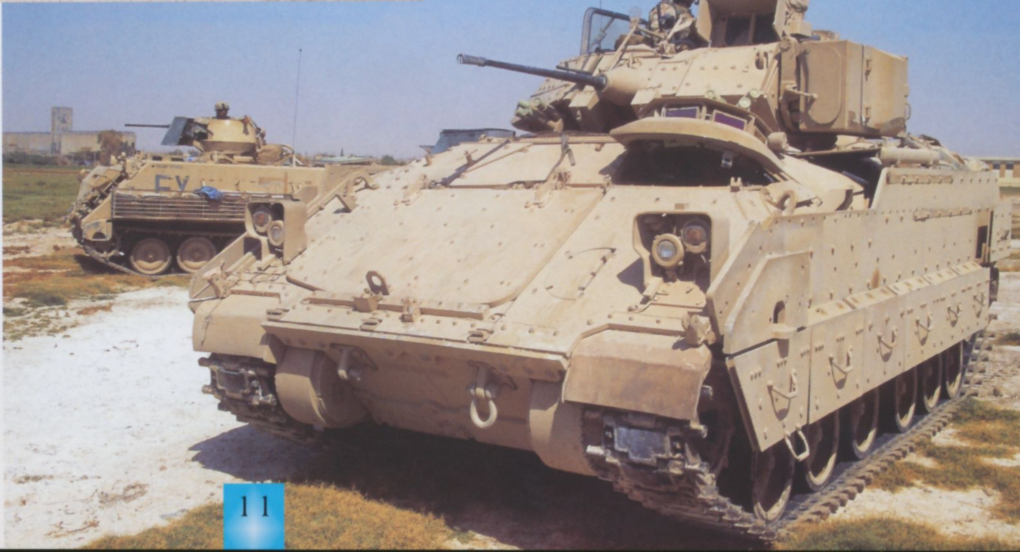
Another picture of a Flash Checkpoint in Samarra. The two M2A2ODS Bradley IFVs belong to A Company, 3rd Battalion, 69th Armor Regiment. The M2A2ODS Bradley IFV has a combat weight of 29,940kg, including the ERA kit. On board are 900 rounds of 25mm ammunition, 2,200 rounds of 7.62mm ammunition, and seven TOW missiles. The vehicle is 2.97m high, 3.61m wide and 6.55m long. Powered by a Cummins VTA-903T diesel engine that develops 608hp, the vehicle can attain a top speed of 61km/h.



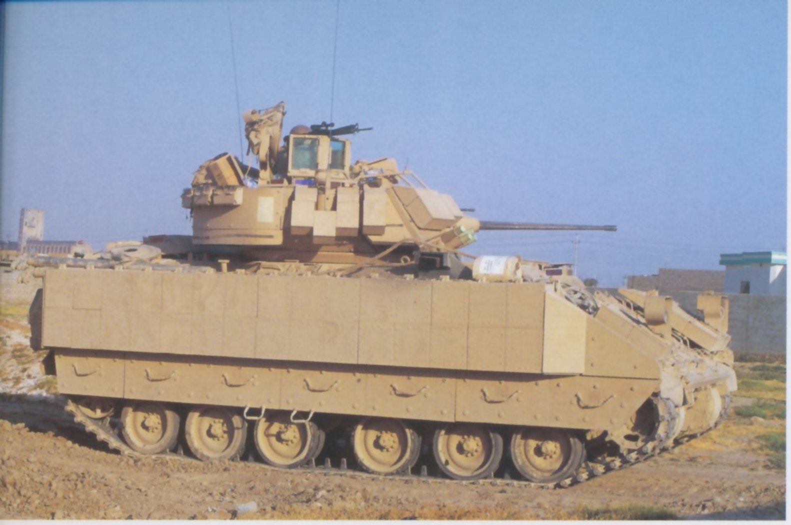
An M3A2 Bradley IFV of the 2nd Squadron, 3rd Armored Cavalry Regiment, seen during the fighting in Tall Afar in August 2005. The vehicle is fitted with the ERA kit, and an HMMWV ASK bulletproof window has been mounted on the turret on the commander's side.



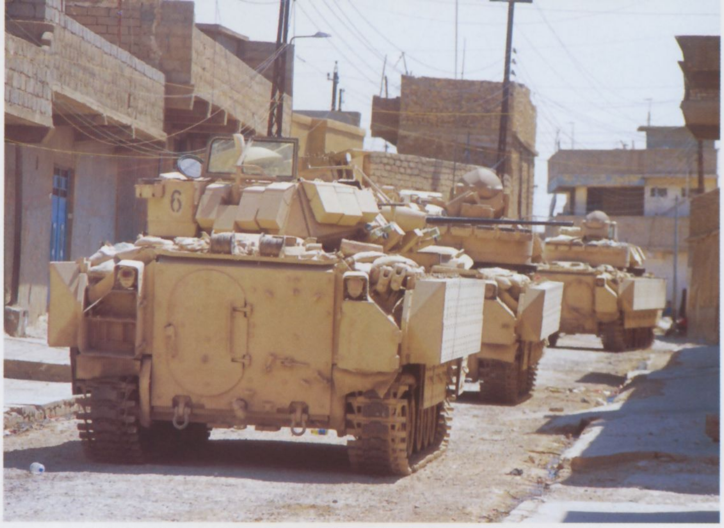
Side view of an M3A2 Bradley CFV of the 2nd Squadron, 3rd Armored Cavalry Regiment. The crew has placed sandbags around the large hatch over the rear compartment. This is a common practice carried out in order to provide troops with additional protection from small-arms fire when standing in the open hatch.



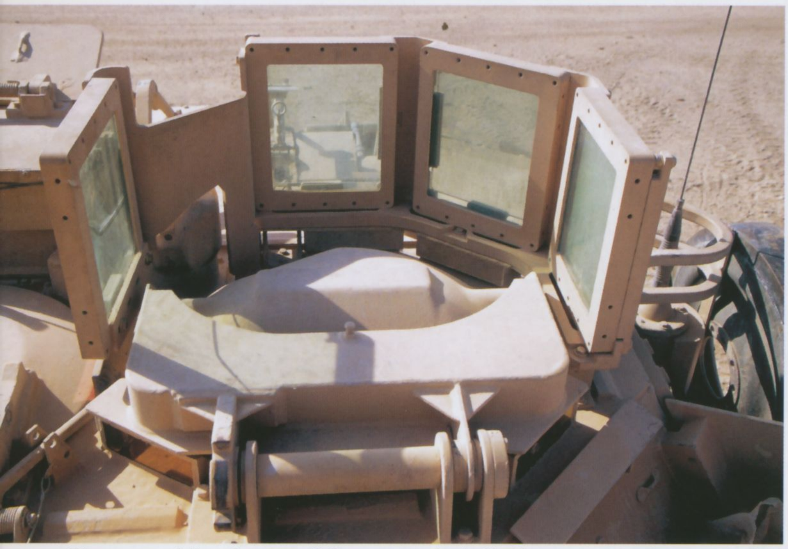
The M3A2 Bradley Cavalry Fighting Vehicle is the main weapon system used by the armored reconnaissance units of the U.S. Army. The vehicle is nearly identical to the M2A2 Bradley Infantry Fighting Vehicle, but it only offers space for two dismounts in the rear, plus it can carry more ammunition and TOW missiles. This M3A2 Bradley CFV belongs to the 3rd Armored Cavalry Regiment and was seen in Tall Afar in August 2005. Note that the vehicle is not fitted with the ERA kit.



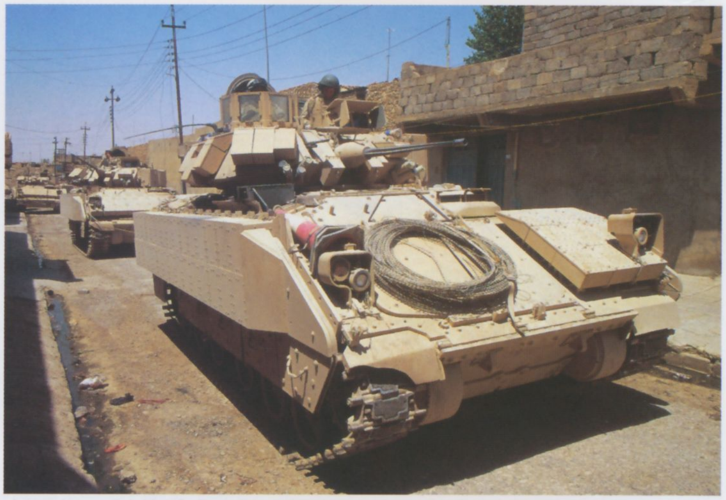
This M3A2 Bradley CFV was seen operating in the suburbs of Tall Afar in August 2005. This vehicle of the 2nd Squadron, 3rd Armored Cavalry Regiment, is fitted with the ERA kit and features an Armored Commander's Station. Observable are the thirty M5A1 reactive armor tiles mounted on the hull side, the M6A1 square box-shaped tiles, and the M7A1 beveled tiles on the turret.



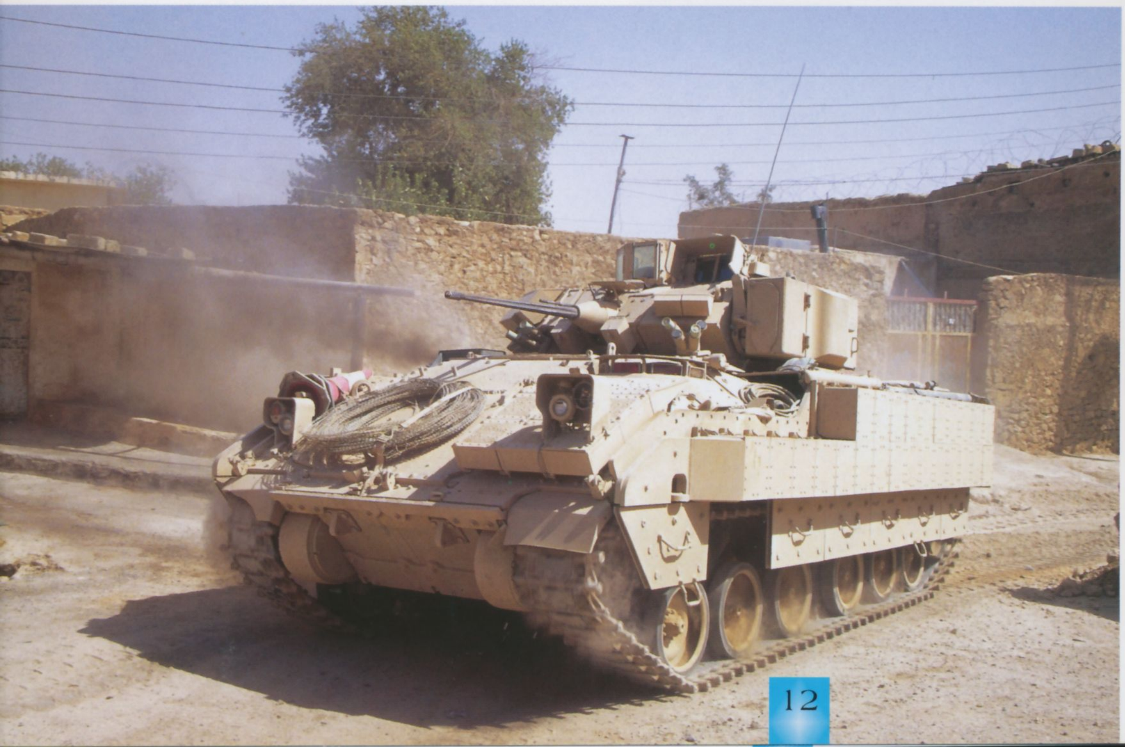
August 2005, three M3A2s of the 3rd Armored Cavalry Regiment operate in the center of Tall Afar. All vehicles are fitted with the ERA kit. Note the armored windscreen from the HMMWV ASK mounted in front of the commander's cupola on the nearest M3A2. The missing firing ports in the rear ramp are one of the major distinguishing features that help identify a CFV from an IFV.



Close-up of the Armored Commander's Station mounted on an M3A2 Bradley CFV. Once the hatch has been opened to the upright position behind the commander, the Armored Commander's Station will provide 360° protection for the commander.

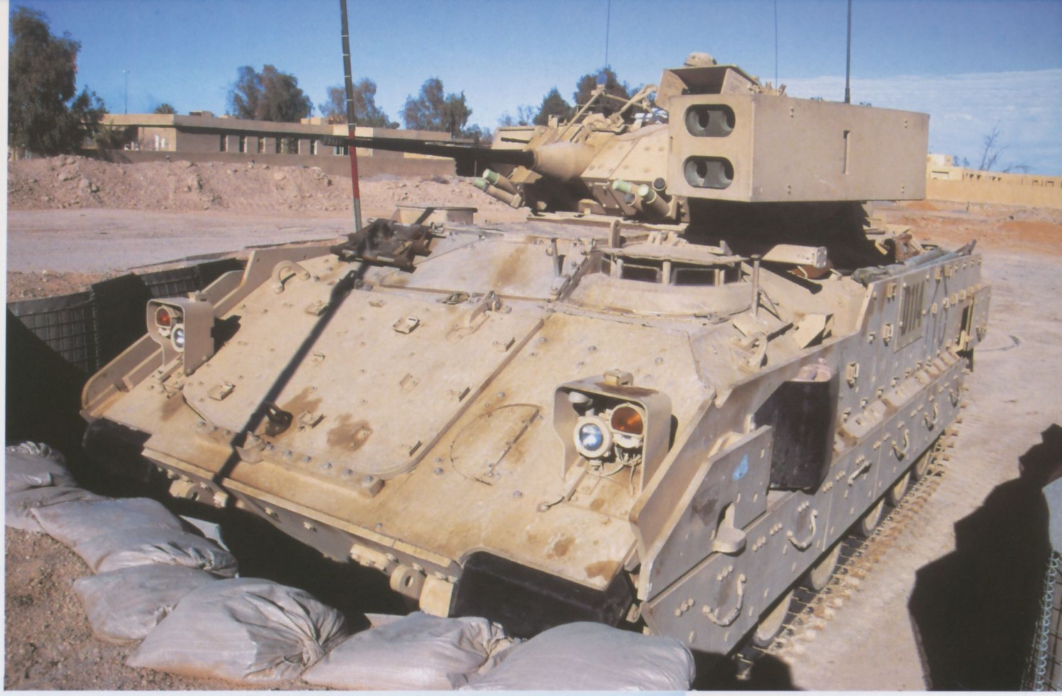


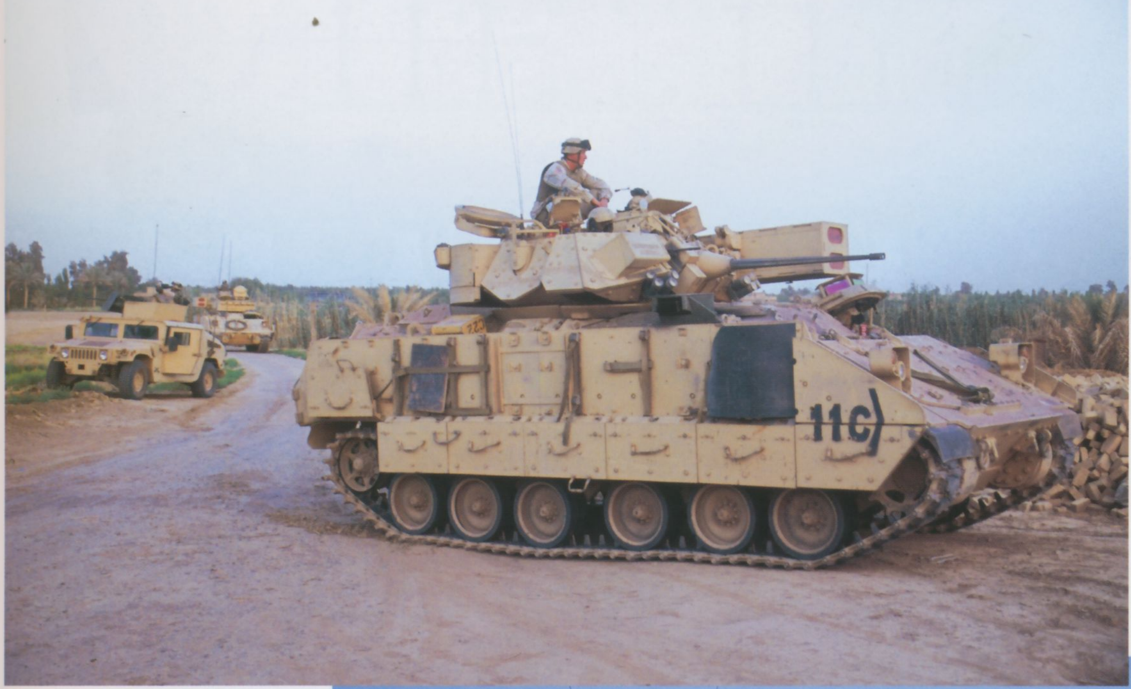
A series of M3A2 Bradley CFVs of "Eagle" Troop, 2nd Squadron, 3rd Armored Cavalry Regiment, has blocked a road during a search operation in Tall Afar in August 2005. While the first vehicle is missing some parts of its ERA kit, the other vehicles feature a full complement of reactive armor tiles. Note the Armored Commander's Station on the first M3A2, with its obvious protective function.



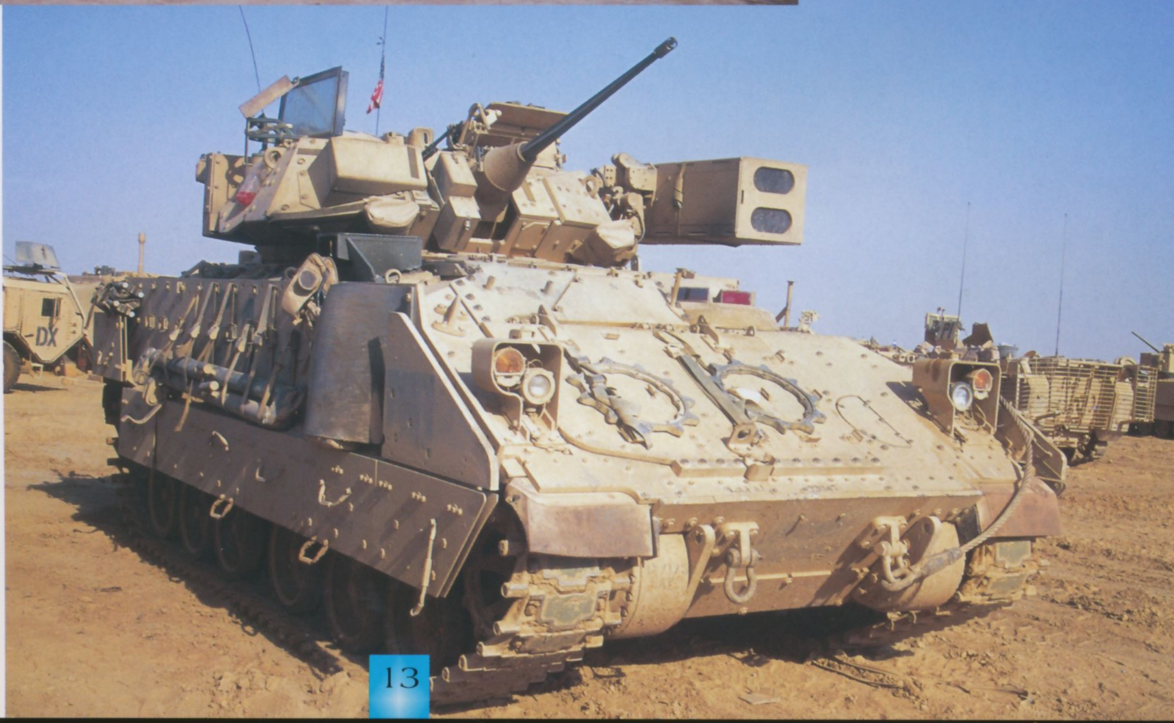
Another picture of the same M3A2 of "Eagle" Troop, 2nd Squadron, 3rd Armored Cavalry Regiment, as it thunders down a road in the city of Tall Afar. Originally designed for a conventional conflict, the Bradley has capably proven its worth during engagements with insurgents in Iraq. Shortcomings of the vehicle identified during heavy fighting in the Iraqi cities were solved with rapid fielding initiatives such as the fitting of Armored Commander's Stations to several vehicles.

Due to the fact that there has been no air threat for U.S. troops in Iraq since the end of the initial fighting, the M6 Bradley Linebacker was assigned new tasks. This vehicle of the 1st Battalion, 44th Air Defense Artillery Regiment, was seen guarding the HQ of the 4th Infantry Division in Tikrit. Other M6 Bradley Linebackers were seen patrolling roads in Iraq, guarding checkpoints, or supporting troops during search operations.

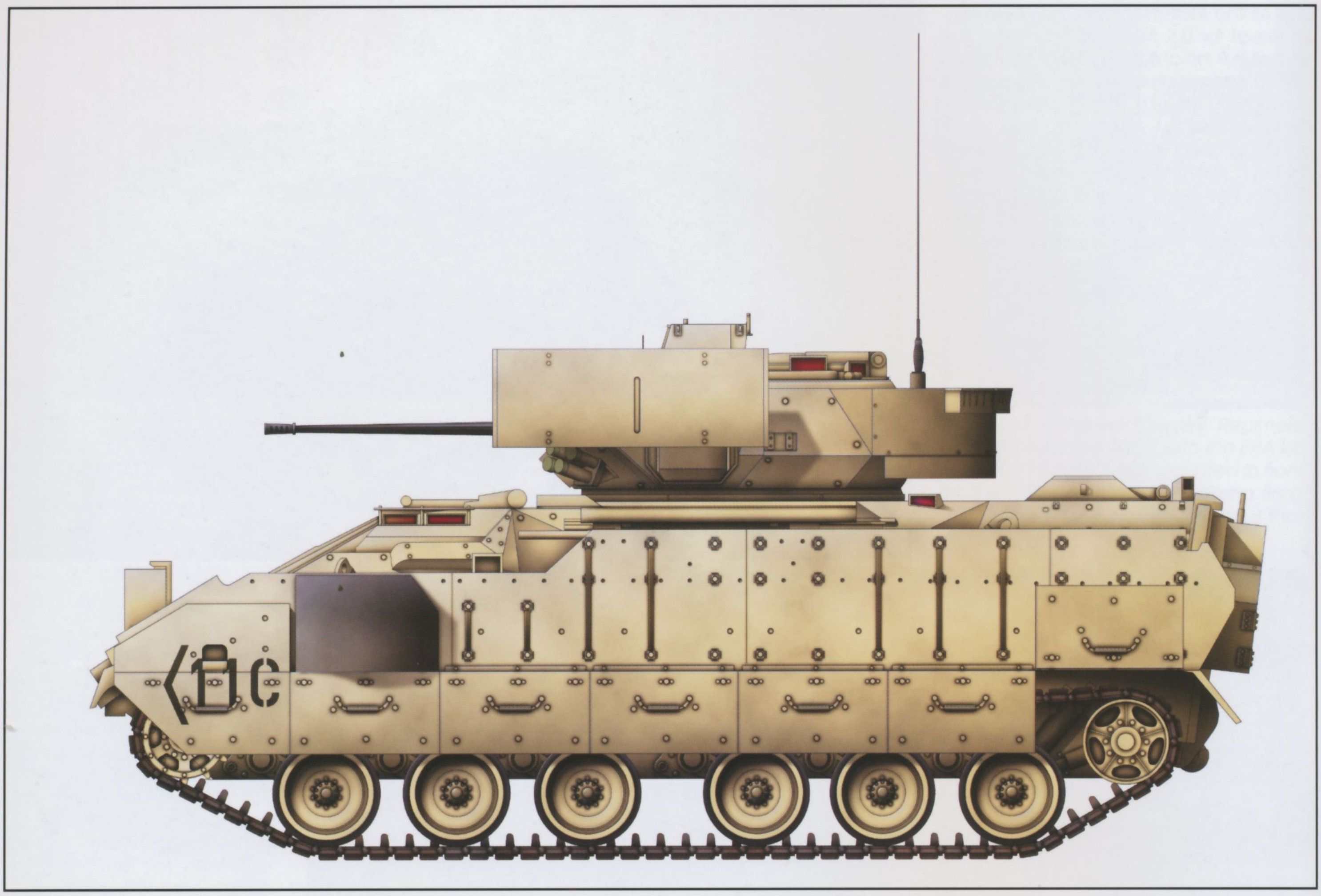




July 2005, this M6 Bradley Linebacker and M1114 Up-armored HMMWV were seen on patrol near Balad; they belong to the 5th Squadron, 7th Cavalry Regiment. The unit was in the process of transforming from an air defense to an armored reconnaissance unit when it deployed to Iraq. Before the unit was called up, 1st Battalion, 3rd Air Defense Artillery Regiment had provided close air defense for the 3rd Infantry Division.

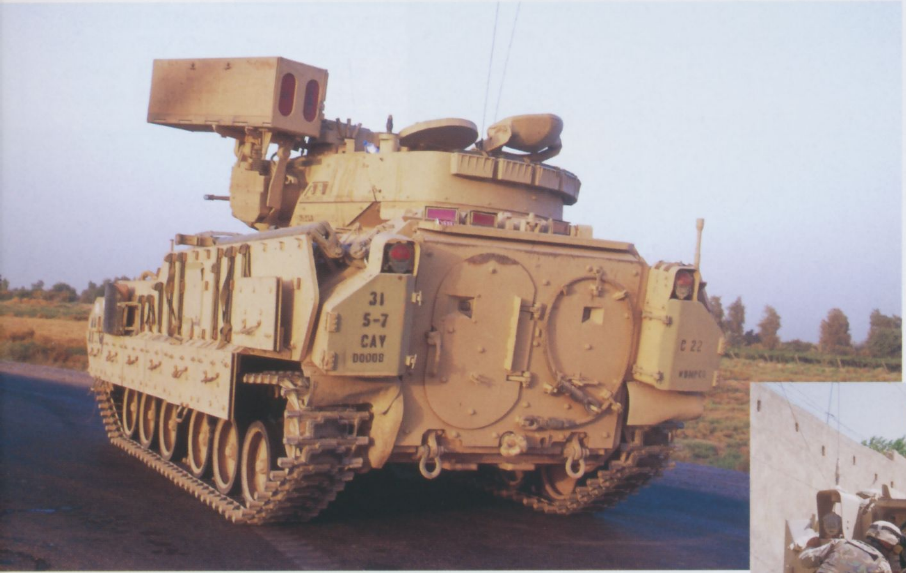


This M6 Linebacker was seen at Tall Afar airfield in August 2005. The vehicle belongs to the Air Defense Artillery Battery "Predator" of the 3rd Armored Cavalry Regiment. Like other units in Iraq, the battery performed ordinary infantry tasks with their M6 Linebackers. Note the HMMWV ASK windscreen mounted on the turret.

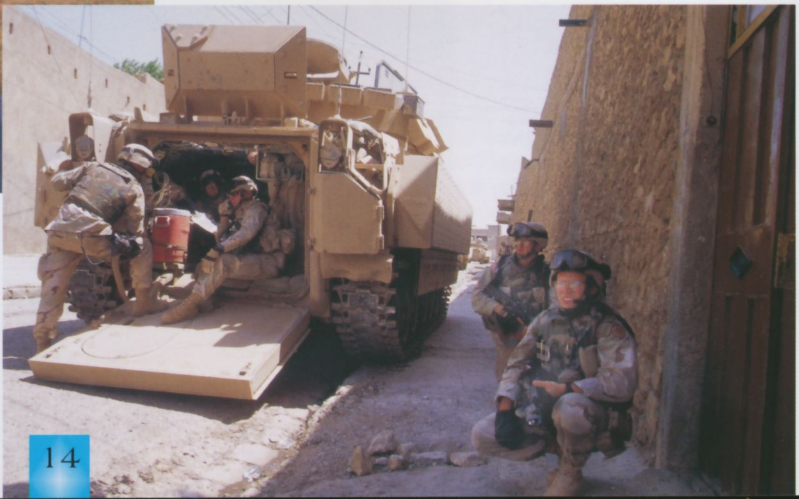


M6 Linebacker, 5th Squadron, 7th Cavalry Regiment, near Balad, July 2005

The M6 Bradley Linebacker Short-Range Air Defense System is used in Iraq for convoy patrol and base protection rather than in its air defense role. Instead of the TOW launcher, the M6 Bradley Linebacker is fitted with four Stinger Surface-to-Air Missiles contained within the Standard Vehicle-Mounted Launcher. The pictured vehicle belongs to the 5th Squadron, 7th Cavalry Regiment, which was in the process of converting from an air defense unit to a reconnaissance unit when it deployed to Iraq in late 2004.

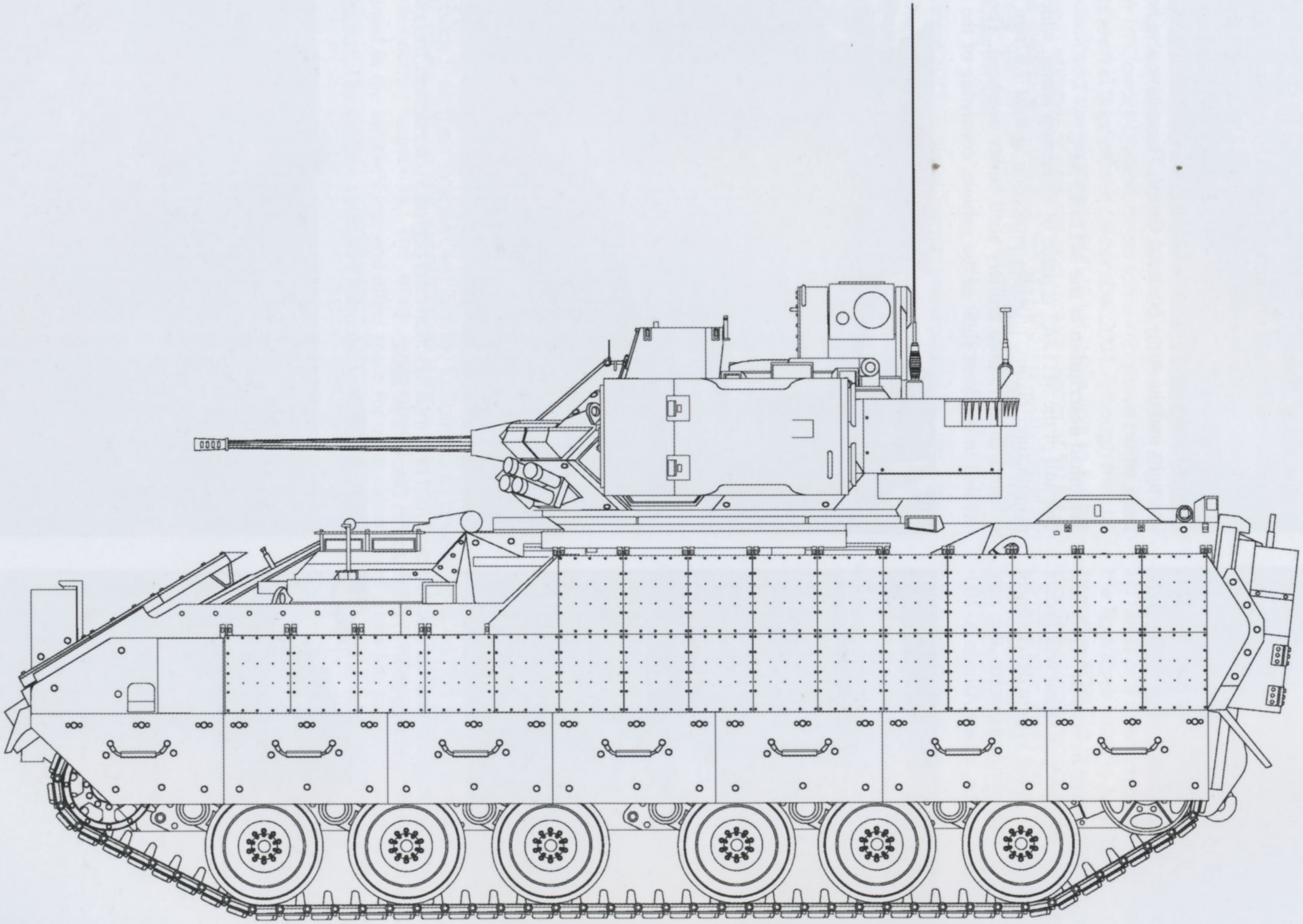


Another picture of an M6 Bradley Linebacker of the 5th Squadron, 7th Cavalry Regiment. Just for the camera, the crew has raised the Standard Vehicle-Mounted Launcher with its four Stinger Surface-to-Air Missiles. The SVML, the Stinger fire control system, the Slew-to-Cue system, and the Sentinel Radar target acquisition system, are the major features unique to the M6 Bradley Linebacker.



From his command vehicle, an M3A2 Bradley CFV, a troop commander of the 2nd Squadron, 3rd Cavalry Regiment, gives orders by radio to his fighting assets. Evident are the large rear ramp and the hatch over the Bradley's rear fighting compartment. Note the steel appliqué armor elements added to the hatch, which are A2 modifications.

1/35 M2A3 Bradley

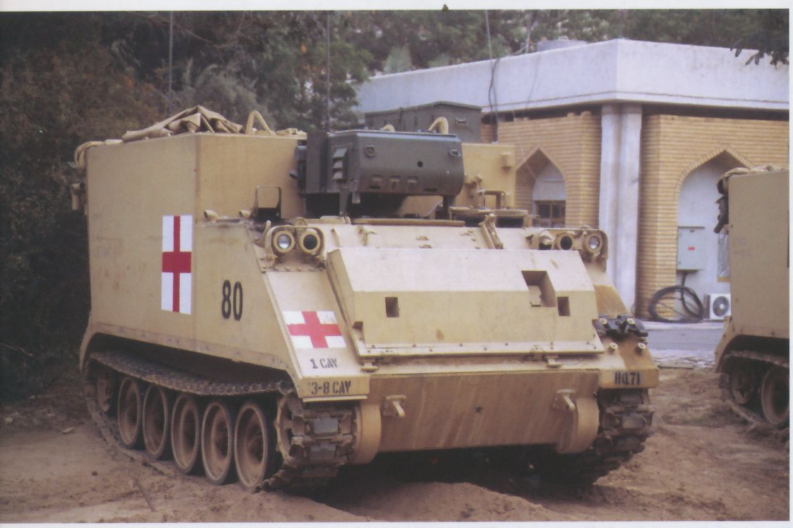


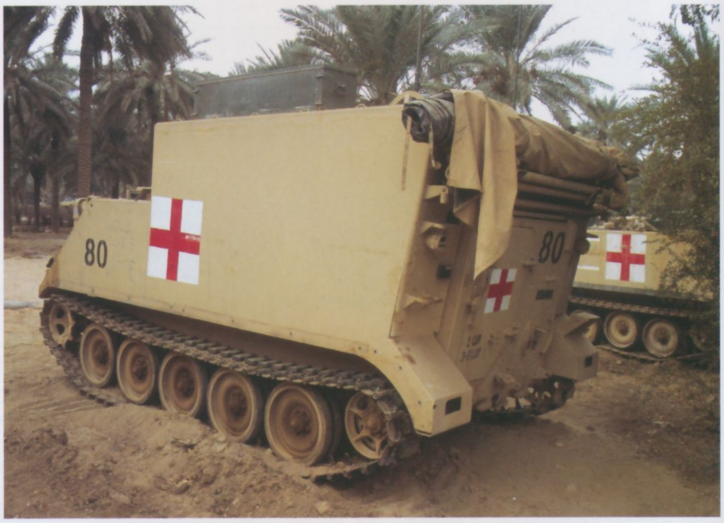
The M113 entered service with the U.S. Army as an armored personnel carrier in 1960. The M113 first saw combat in Vietnam. While it was replaced by the M2 Bradley IFV in the 1980s as the primary vehicle of mechanized infantry units, it remained in service in countless specialized versions such as an armored ambulance, engineer squad vehicle, command post vehicle or mortar carrier. When the 2003 Iraq War started, the U.S. Army was still operating over 17,000 vehicles of the M113 family, including the M548 cargo carrier. Therefore, it is no wonder that the M113 family saw extensive use with frontline units. Since its first fielding, the M113 family has undergone several upgrade programs. Originally developed with a petrol engine, the M113A1 was remanufactured with a new diesel engine and new transmission. From 1978 onwards, the U.S. Army M113 family was upgraded to A2 standard, which featured an improved engine cooling system and modified suspension.

Between 1987 and 2001, the U.S. Army modernized most of its M113 fleet to M113A3 standard. In U.S. Army terms, this modernization was known as the RISE program, and it was the result of a future system development program carried out by TARADCOM. Improvements were the new turbocharged 275hp 5.2-liter 6V53T diesel engine, a new Allison X-200-4A automatic transmission, hydrostatic steering, new driver controls with a steering wheel and brake pedal, a 200-amp generating system with four 12-volt batteries, external armored fuel tanks, a spall suppression liner, and preparation of the vehicles so that passive add-on armor could be fitted. A new trim vane also became standard issue on all A3 vehicles. With the RISE program there was also a change of number designations for some of the U.S. Army M113 fleet. The mortar carrier that was now fitted with a 120mm M120 mortar received the designation M1064A3. The command post vehicle was given the name M1068A3 Standard Integrated Command Post. A new smoke-generating vehicle was also introduced and designated M58. While most U.S. Army M113s have today been upgraded to A3 standard, there are still a lot of earlier A2 standard models in use by second-line units and the Army National Guard. These have also been deployed to Iraq.

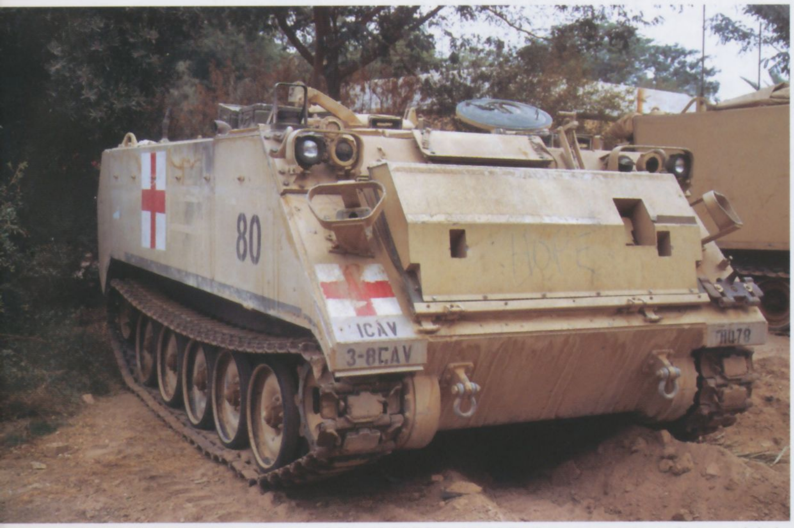
Technical description of the M113A3 APC

The hull of the M113A3 is made of aluminum armor, which, according to manufacturer claims, provides protection against 7.62mm AP rounds and splinters from 155mm artillery shell bursts overhead. The power train is situated in the front right of the vehicle, consisting of the 5.2-liter water-

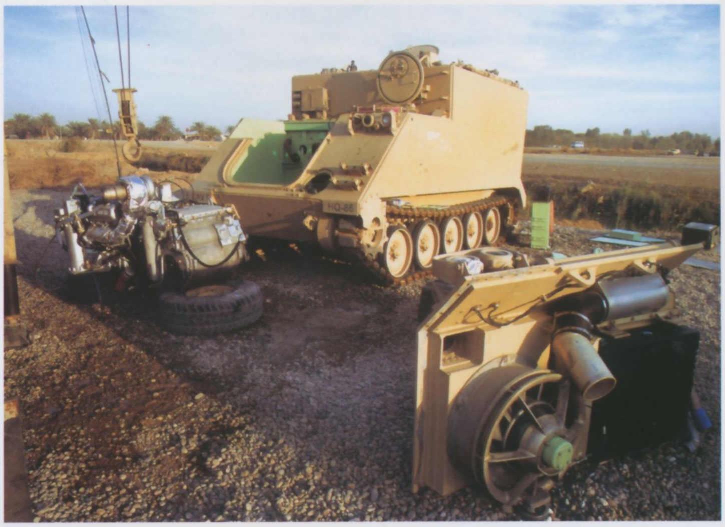




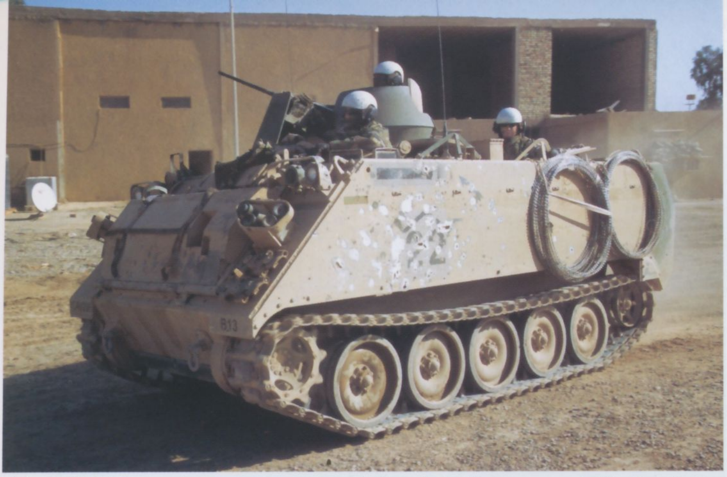
Here an M1068A3 Standard Integrated Command Post can be seen serving as a medical vehicle. The medical treatment squads of battalion medical platoons can field two such vehicles; they can be connected by a tent and thus function as a battalion aid station. The pictured vehicle belongs to 3rd Battalion, 8th Cavalry Regiment, and was seen in Baghdad in December 2004.



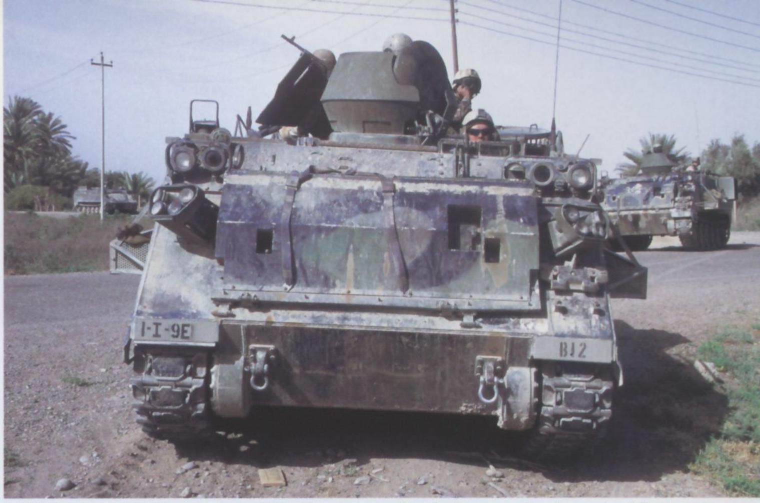
Since the introduction of the M113 into U.S. Army service, the vehicle has served as an armored ambulance in addition to being a troop carrier. This M113A3 armored ambulance belongs to the medical platoon of the HHC, 3rd Battalion, 8th Cavalry Regiment. The ambulance can be used to evacuate up to four patients on stretchers. The new trim vane that has become standard with all M113A3s can be seen in this view.



The dust and heat in Iraq are demanding on military hardware, often resulting in technical problems. Only regular maintenance can prevent mechanical failure during operations. Here the 5.2-liter water-cooled turbocharged 6V53T diesel engine can be seen extracted from an M1068A3 Standard Integrated Command Post. The vehicle belongs to the HHC of the 1st Cavalry Division, and was seen at Camp Victory in December 2004.



This M113A3 engineer squad vehicle of B Company, 20th Engineer Battalion of the 1st Cavalry Division, bears some impressive battle scars on its hull. It was seen in Baghdad in December 2004. Although the U.S. Army has not disclosed the number of M113A3s lost in Iraq so far, the author has seen a number of pictures and actual wrecks of M113s in scrap yards. This evidence proves that the M113A3 is an easy target for insurgents armed with RPG-7 antitank weapons or using IEDs made from 155mm artillery shells.



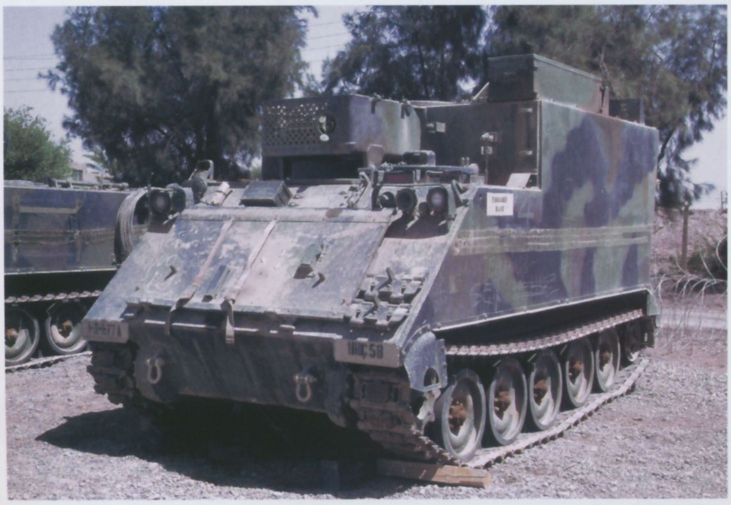
M113A3s of B Company, 9th Engineer Battalion, patrol east of Balad in the Tigris River valley in June 2004. The first vehicle is fitted with a cupola from the ACAV kit that was first used by the U.S. Army in the Vietnam War. The cupola provides protection from small-arms fire for the vehicle commander when he is manning the vehicle's machine gun. Note that when the commander's hatch is open it protects the half-open rear section of the ACAV cupola.

cooled turbocharged 6V53T diesel engine manufactured by the Detroit Diesel Engine Division of General Motors. This unit develops 275hp and is connected to an Allison X-200-4A automatic hydrokinetic transmission with four forward and two reverse gears. Under the trim vane mounted on the front plate is located an engine access hatch. The driver sits at the front left of the hull. He enters his position via a large one-piece hatch that swings opens to the rear. In the hatch the AN/VVS-2 night viewer system can be mounted for driving at night. The station for the vehicle commander is situated in the center of the M113, behind the driver and power train. The roof-mounted commander's cupola can be traversed 360° and features five M17 periscopes, as well as a single-piece hatch that opens to the rear. Also belonging to the commander's cupola is a pintle mount on which the 12.7mm M2 HB heavy machine gun or the 40mm Mk.19 Mod.3 automatic grenade launcher can be mounted. Most M113A3 variants are fitted with a pair of smoke dischargers mounted on the left and right sides of the vehicle's front plate.

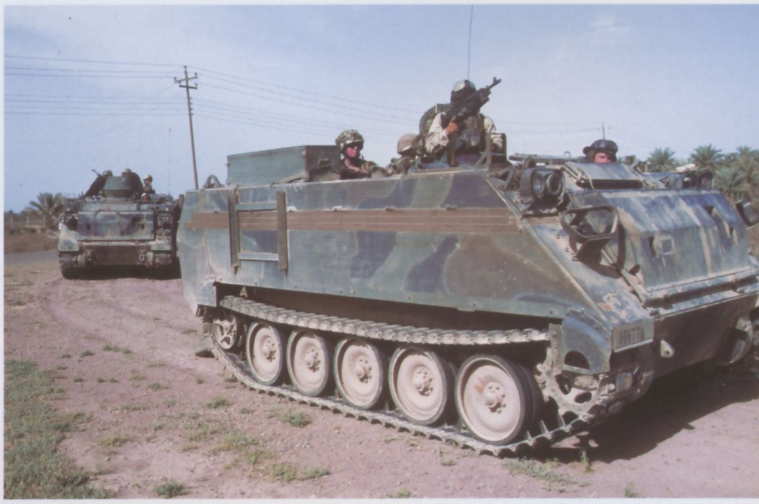
The M113A3's running gear consists of five road wheels, a rear idler and a front drive sprocket on either side. Torsion bar suspension, supported by shock absorbers on the first, second and fifth road wheels, provides a competent cross-country capability. The troop compartment of the M113A3 is situated in the vehicle's rear and offers space for up to eleven soldiers and their kit. The soldiers enter and leave the vehicle via a large power-operated rear ramp in which a door is situated. Inside the troop compartment the soldiers sit along the left and right sides of the hull on detachable benches that face inwards. In the roof above the troop compartment there is a large one-piece hatch that opens to the rear. Outside the hull to the left and right of the rear ramp are located the external armored fuel tanks. Each EFT (External Fuel Tank) can hold up to 180 liters of JP8 fuel, the U.S. Army's standard fuel. The M113A3 is fully amphibious. When operating in water, the vehicle is driven and steered by its tracks. For amphibious operations the trim vane is erected, but normally it is folded back against the front plate. Two bilge pumps take care of any water ingress.

M113A3 Add-on Armor Suite

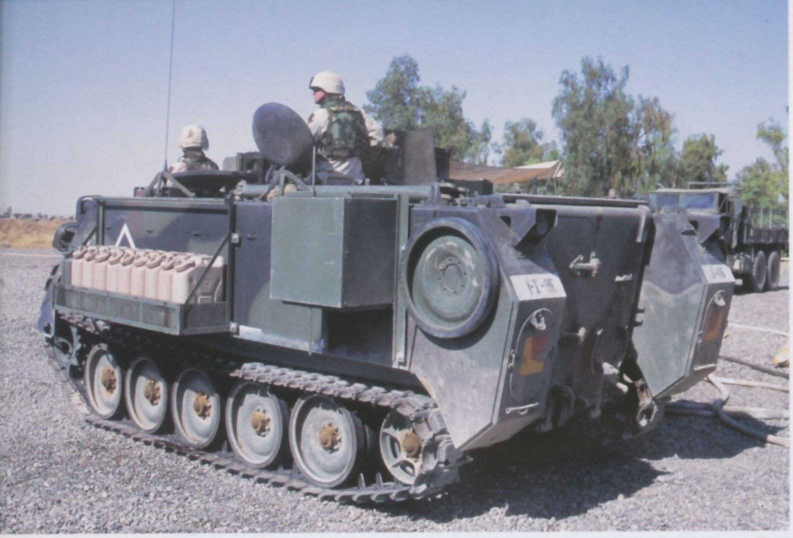
For some reason the U.S. Army never purchased passive add-on armor for the M113, even though the M113A3 received preparations for its fitment. This fact proved fatal during the first years of the Iraq conflict. Wrecks of M113A3s seen in vehicle graveyards in Iraq with fist-sized holes in their aluminum hulls induce observers to only guess what might have happened to their crews. In order to minimize the danger for troops operating in M113s in Iraq, the Combined Forces Land Component Command issued an operational needs statement on 23 December 2004. This required the fitting of armor kits to a total of 734 M113 variants operated by U.S. troops. The number was broken down as follow: 504 M113A3s (including engineer



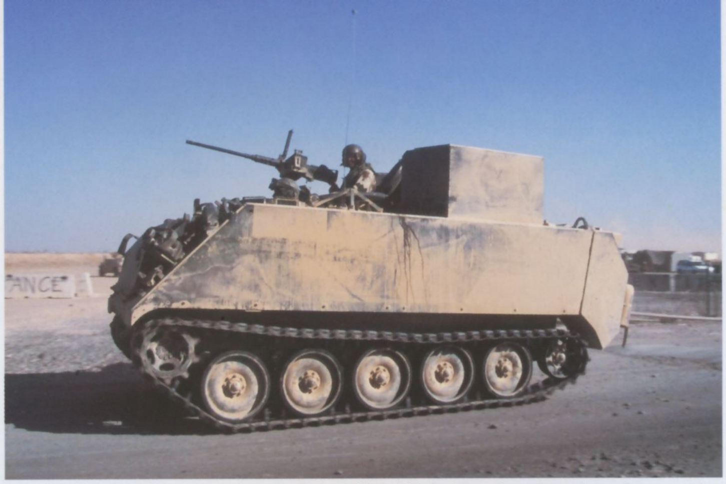
This M577A2 Command Post Carrier is being used as a Fire Direction Center by Platoon HQ of the Mortar Platoon of 1st Battalion, 77th Armor Regiment. The vehicle was seen at FOB Paliwoda, south of Balad, in May 2004. The CPC features a raised hull so that large map boards can be mounted in the rear. Special equipment in the vehicle includes a manually operated crane and a generator.



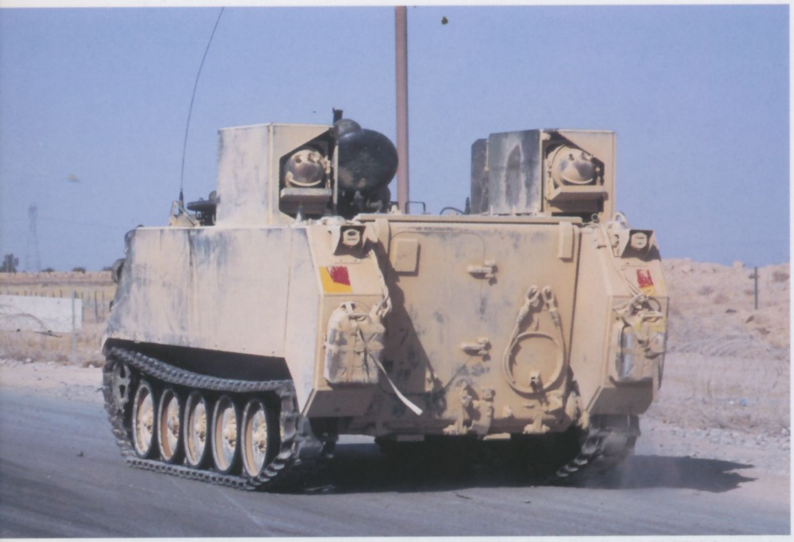
This M113A3 belongs to the 1st Battalion, 77th Armor Regiment, of the 1st Infantry Division. The vehicle was seen on patrol near Balad in May 2004. The M113A3 has a combat weight of 12,247kg. It is powered by a 5.2-liter water-cooled turbocharged 6V53T diesel engine that develops 275hp, allowing the vehicle to reach a maximum speed of 66km/h.



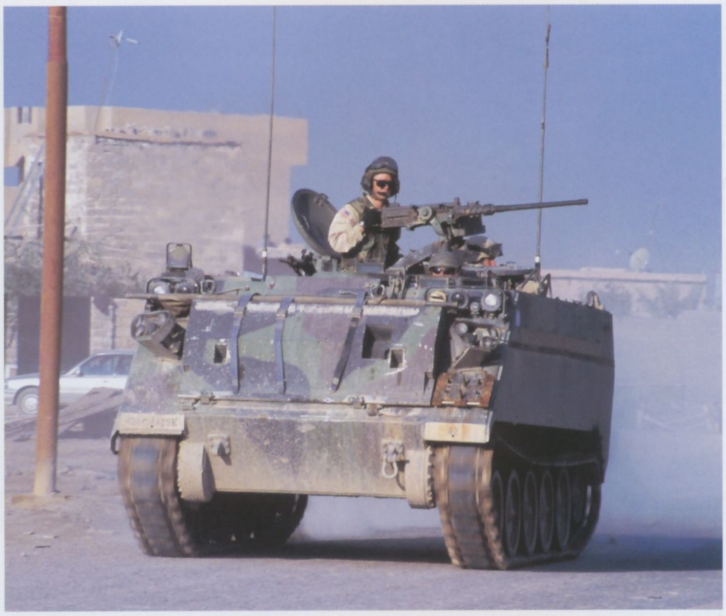
Rear view of an M113A3 APC used by the 9th Engineer Battalion. The vehicle was seen at FOB Summerall, Bayji, in May 2005. Note the external storage racks containing jerry cans and other equipment mounted on the vehicle's side. The racks were fixed to the mounting points originally designed as attachment points for the vehicle's add-on armor.



May 2004, FOB Speicher - an M1059A3 Carrier Smoke Generator moves out on patrol. The vehicle belongs to the 12th Chemical Company of the 1st Infantry Division "Big Red One". In Iraq, M1059A3s are mainly used by units to provide camp security, to act as roadblocks during vehicle checkpoints, or simply as patrol vehicles. The vehicle's M157A2 smoke generator system is seldom, if ever, used to lay smokescreens in order to protect troops from the view of the enemy.



The M1059A3 Carrier Smoke Generator is fitted with the M157A2 smoke generator system that can be seen here on the vehicle's roof. The vehicle crew consists of the vehicle commander, the driver and the smoke generator operator. For the M157A2 smoke generator system, 438 liters of fog oil is carried in a tank in the rear compartment of the vehicle. This allows the vehicle to maintain a continuous smokescreen for a period of well over an hour. The pictured vehicle belongs to the 12th Chemical Company and was seen near Tikrit in May 2004.



December 2003, an M113A3 of an engineer unit thunders down a road in Fallujah. Note that the vehicle lacks any add-on armor or any additional protection for the commander who is manning the machine gun. It was this absence of adequate armor protection that led to a large number of U.S. casualties in Iraq when insurgents became more and more daring.

section vehicles and armored ambulances), thirty-nine M1064A3 mortar carriers, ninety-nine M577A3 command post vehicles, and ninety-two M1068A3 command post vehicles. Subsequently, Project Manager Combat Systems of the U.S. Army teamed up with United Defense LP (a subsidiary of BAE Systems) and developed the Add-on Armor Suite, which was partly inspired by the slat armor used on the Stryker IAV. On 8 February 2005, United Defense LP announced that they had received a US$30 million contract to supply, amongst other equipment, Add-on Armor Suites for M113A3 family vehicles. The M113A3 Add-on Armor Suite consists of the following components:

Bar armor: providing 360° protection from RPG attacks.

Transparent Armor Gun Shield: providing protection against 7.62mm ball ammunition, and improving situational awareness with transparent plates. It utilizes the existing 0.50-cal mount and can be installed by the crew.

Mine Protection: providing protection for mines or IEDs up to 22kg in size. This is achieved by installing armor under the vehicle's hull, including a Bottom/Sponson Plate on the driver's side.

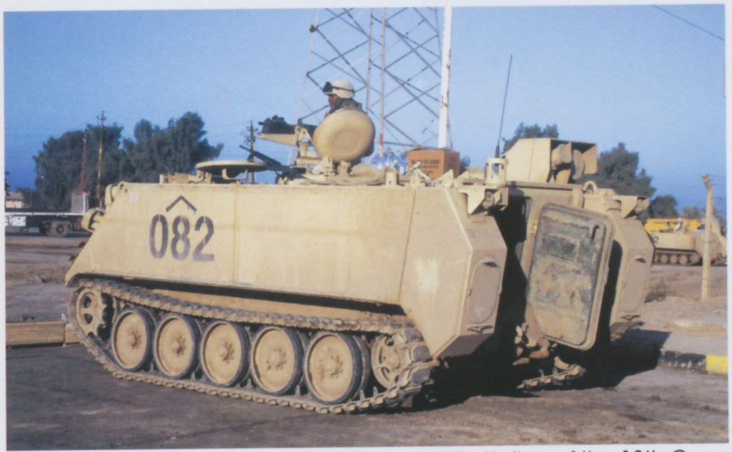
High Hard Appliqué: providing 360° armor protection from 14.5mm rounds.

Cupola Armor: providing 360° protection for the commander from 7.62mm AP rounds.

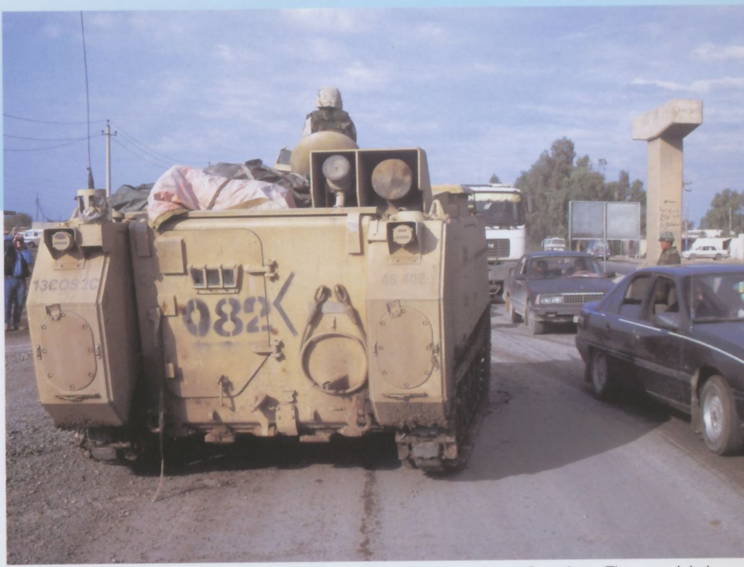
The Add-on Armor Suites for the M577A3 and M1068A3 are identical to that of the M113A3. Therefore, the raised superstructure over the rear compartment of the vehicle is not provided with any additional protection. The first Add-on Armor Suites left the production plant in early May 2005 and were flown directly to Iraq. In the meantime, United Defense LP had established a facility at Baghdad International Airport called "Survivability Enhancement Armor M113 Add-on Armor Installation Site". It was here that the first M113A3s of the U.S. Army were fitted with the Add-on Armor Suite in Iraq on 27 May 2005. Some forty-two vehicles were upgraded per week, with the fitting of the Add-on Armor Suite taking twelve working hours for an installation team of five men. Work was carried out in two twelve-hour shifts at the facility, each shift comprising three teams of civilian contractors and U.S. Army mechanics. Work continued up till 31 July, by which date all 734 vehicles of the M113A3 family had been fitted with the Add-on Armor Suite.

Technical Data for M113A3

Crew:	2 (driver and commander) and up to 11 passengers.
Combat weight:	12,247kg
Curb weight:	10,832kg
Length:	5.3m
Width:	2.69m
Height (to top of commander's station):	2.22m
Engine:	5.2-liter water-cooled turbocharged 6V53T diesel engine developing 275hp, from Detroit Diesel Engine Division General Motors
Maximum speed:	66km/h
Maximum amphibious speed:	5.8km/h
Transmission:	Allison X-200-4A automatic hydrokinetic transmission with four forward gears and two reverse gears.
Trench crossing:	1.68m
Ground clearance:	0.43m
Cruising range:	483km
Fuel capacity:	360 liters
Vertical obstacle:	610mm
Frontal slope:	60%
Side Slope:	30%
Track width:	380mm
Armor of basic hull:	5083 Aluminum

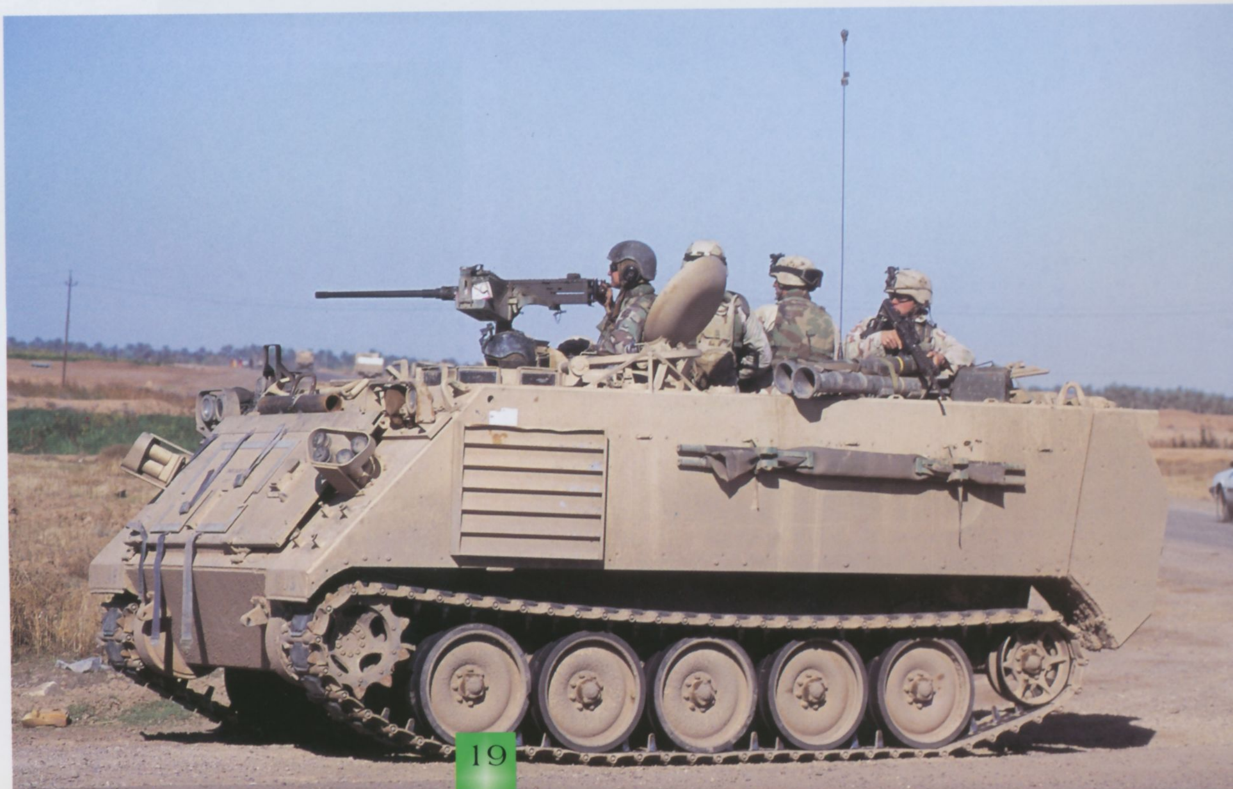


This M58 Wolf belongs to the 2nd Chemical Battalion of the 13th Corps Support Command, and it was seen somewhere north of Baghdad in December 2003. A Chemical Smoke Platoon can field seven M58 Wolf vehicles. The M58 incorporates all the improvements of the M113A3. The M58 Wolf has a three-man crew and entered service with the U.S. Army in 1998.

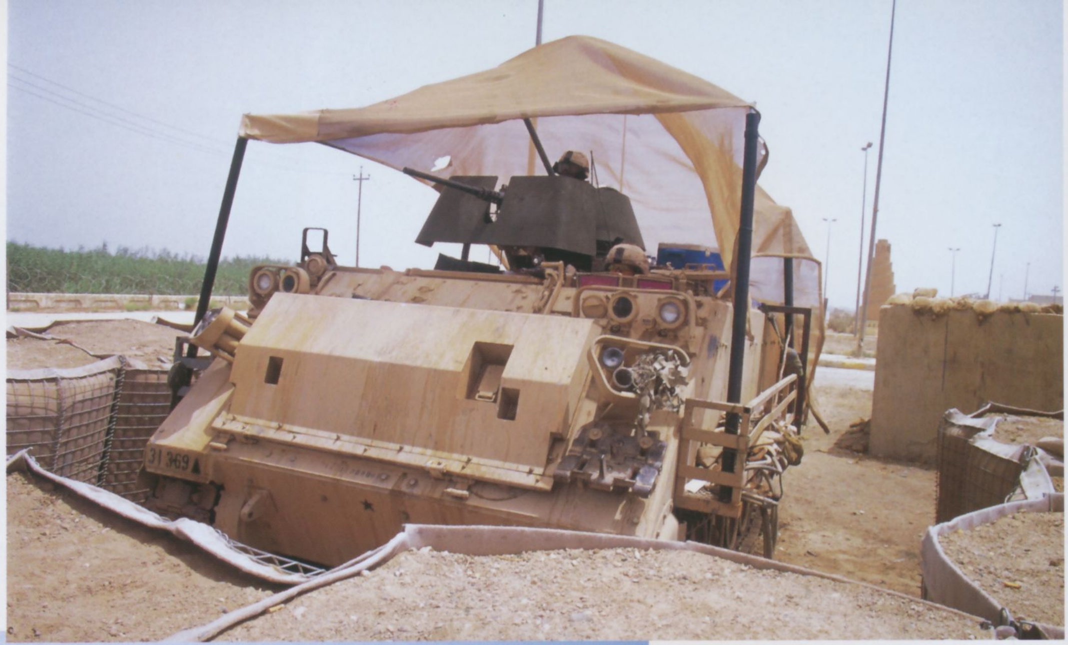


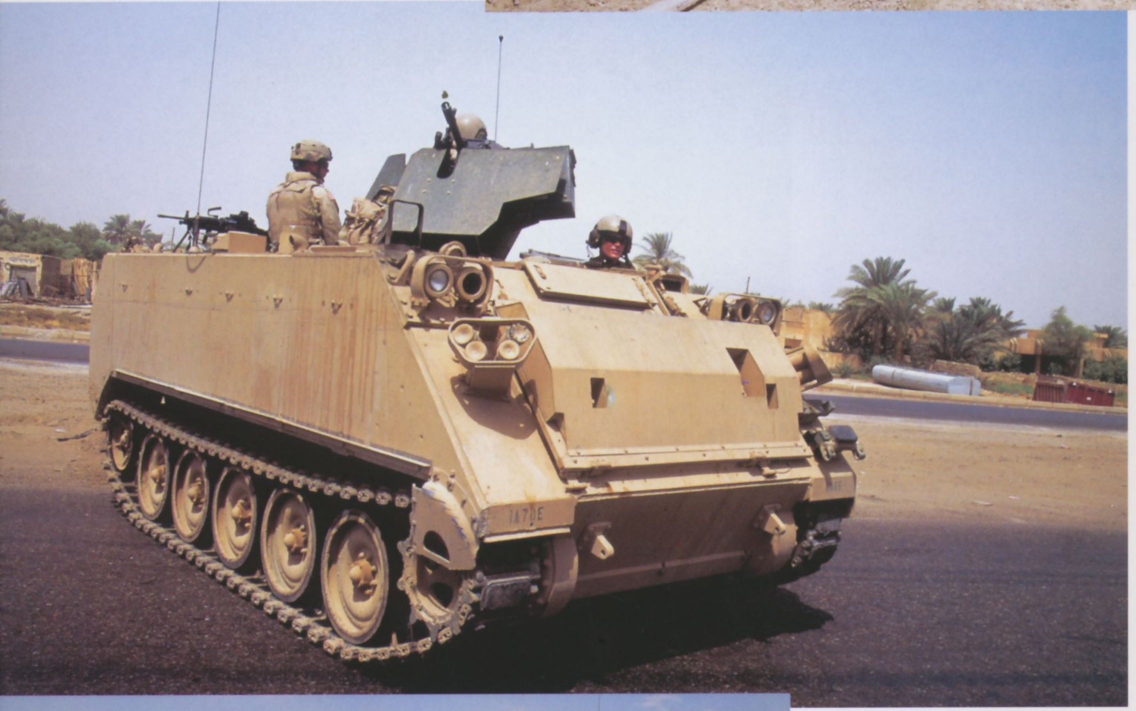
Rear view of an M58 Wolf Smoke Generator Carrier. The vehicle features the Large Area Obscuration System that is able to generate obscuring clouds of smoke that are effective in both the visual and infrared spectrums. Smokescreens can be continuously maintained for ninety minutes with visual-defeating smoke and thirty minutes with infrared-defeating smoke. In Iraq the M58 Wolf is regularly seen in use guarding mobile vehicle checkpoints. The pictured vehicle belongs to the 46th Chemical Company, 2nd Chemical Battalion, of the 13th Corps Support Command, and it was seen on a highway in the western outskirts of Baghdad in December 2003.

This M113A3 belongs to the 4th Engineer Battalion of the 4th Infantry Division, and was sighted south of Balad in December 2003. Note that the vehicle is fitted with the old trim vane that was in use with M113s up to the A2 model. The vehicle features the Identification Friend/Foe system used by the U.S. Army ever since its deployment to Bosnia in 1996.

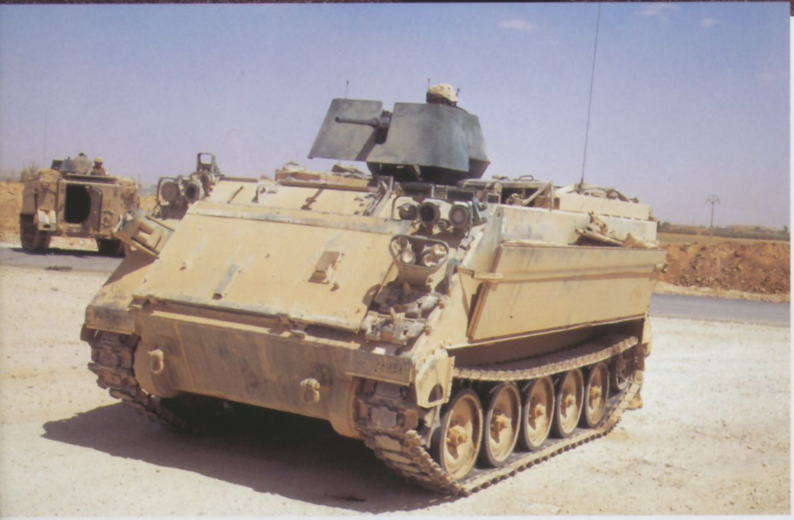


July 2005, Samarra - an M113A3 engineer squad carrier of E Company, 3rd Battalion, 69th Armor Regiment, is deployed to guard a stationary vehicle checkpoint. During Operation Iraq Freedom, M113s were regularly used as armor-protected sentry posts. In addition to providing security for checkpoints, they became gate guards at military installations and functioned as mobile obstacles to block access roads. This measure is necessary to prevent suicide bombers in vehicles packed with explosives from breaking through.

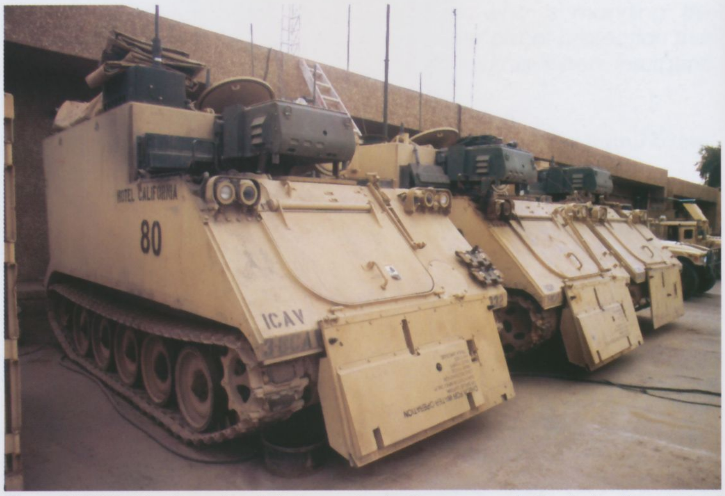




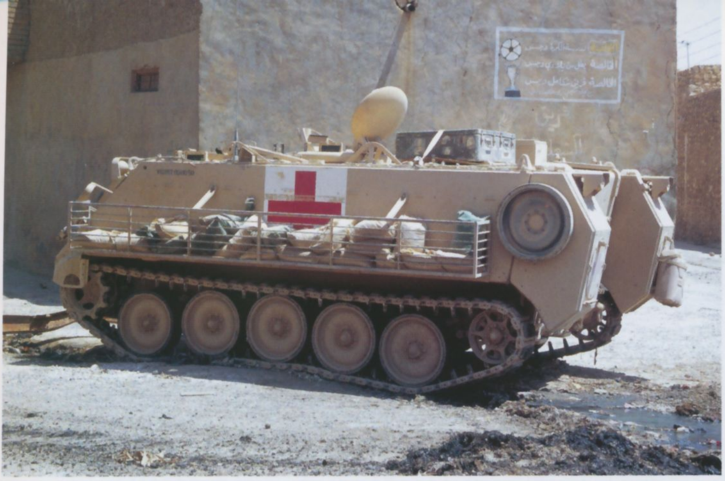
July 2005 – a daily routine. An M113A3 blocks MSR Tampa after an IED made from a 155mm artillery shell was found on the roadside. The vehicle commander's cupola features an ACAV kit, while a Gunner Shield Kit (usually used on HMMWVs) is fitted to the vehicle in order to provide cover for the commander manning the 40mm Mk.19 Mod.3 automatic grenade launcher.



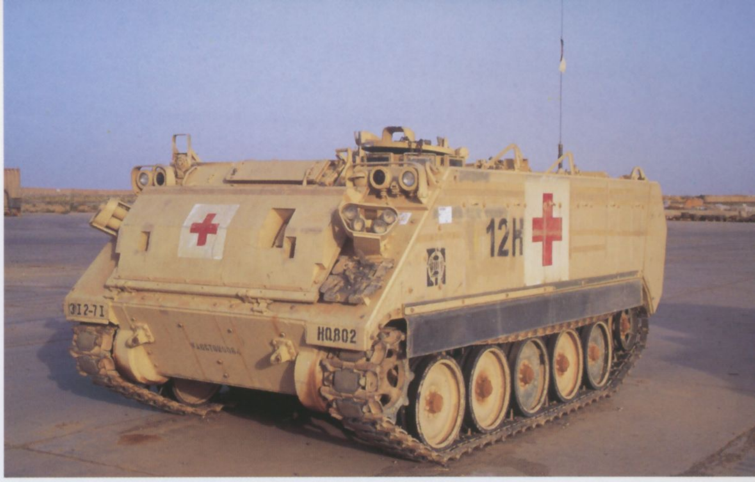
While the U.S. Army modernized a huge number of its M113s to A3 standard, there are still a significant number of M113A2s in service with second-line and Army National Guard units. Thus, the M113A2 also sees service in Iraq. Despite being equipped with smoke grenade launchers, these two vehicles can clearly be identified as M113A2s by the old-style trim vane and the lack of External Fuel Tanks. They belong to an engineer company of the Army National Guard supporting the 3rd Armored Cavalry Regiment in northern Iraq in August 2005.



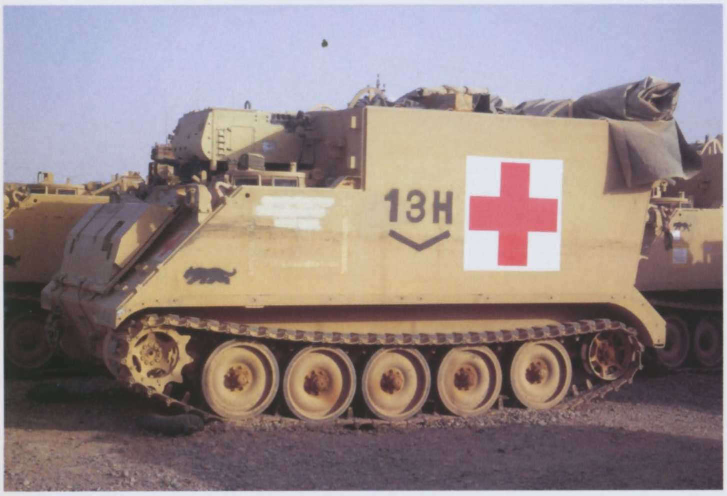
The M1068A3 Standard Integrated Command Post is the latest derivation of the M577. These M1068A3 SICPs belong to the 3rd Battalion, 8th Cavalry Regiment, and were seen in Baghdad in December 2004. The vehicle is fitted with the Army Tactical Command and Control System and features a Tactically Quiet 5kW diesel APU (Auxiliary Power Unit) that can be operated from inside the vehicle; this unit utilizes the vehicle's own fuel supply.



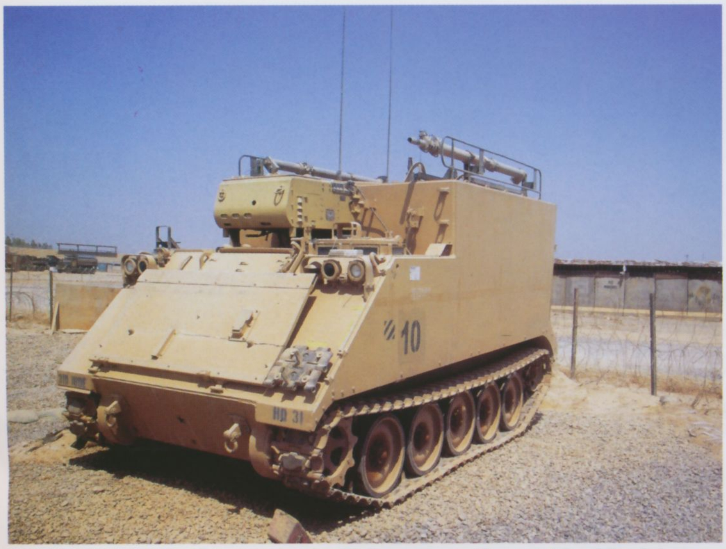
In early August 2005, troops of the 3rd Armored Cavalry Regiment pushed into Tall Afar in order to crush insurgent resistance. This M113A3 ambulance entered the city along with heavily armored Bradleys. Note the storage rack on the vehicle's side. Originally designed to carry some of the crew's equipment, it has been filled with sandbags in order to provide additional protection for the crew.



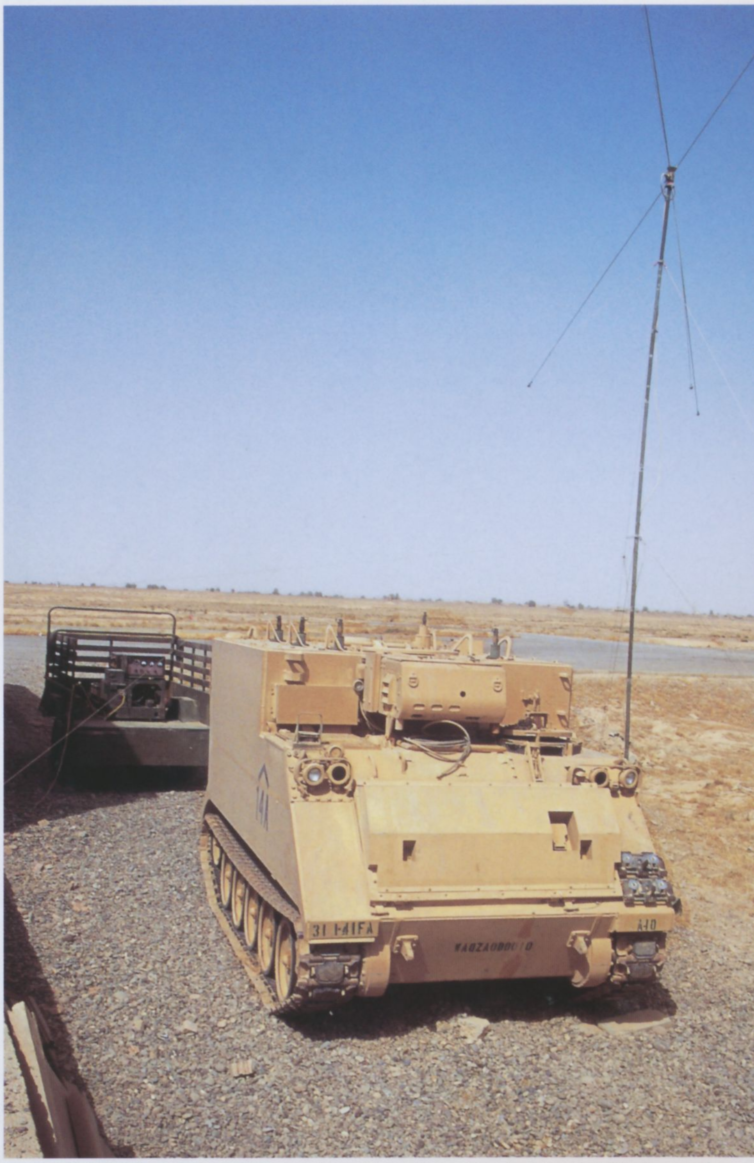
The M113A3 armored ambulance is used to evacuate wounded personnel while under the threat of enemy fire, a tactic commonly needed in Iraq. Four patients on stretchers or eight sitting patients can be carried in the rear of the vehicle. This vehicle belongs to the 2nd Battalion, 7th Infantry Regiment "Cottonbalers", and was seen at Camp Summerall near Bayji in July 2005.



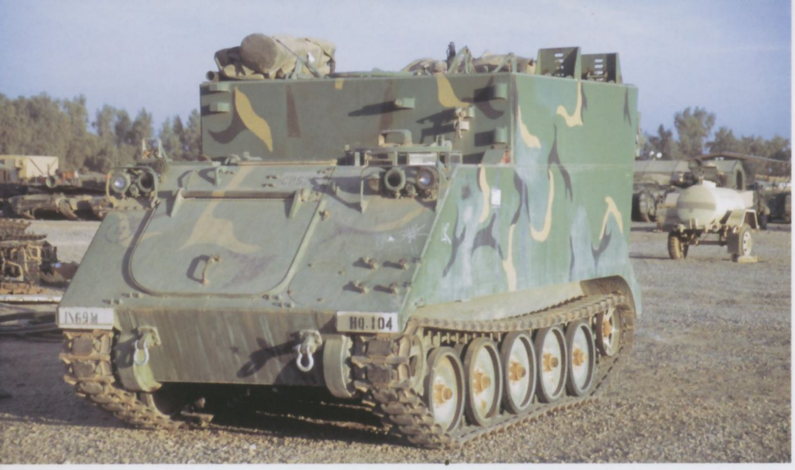
Another picture of an M1068A3 Standard Integrated Command Post. The vehicle belongs to the 3rd Battalion, 69th Armor Regiment. The medical version of the vehicle is used by the battalion's medical treatment squad, and it can function with a second vehicle as a battalion aid station. Note the panther badge on the hull, a logo that reflects the battalion's motto of "Speed and Power".



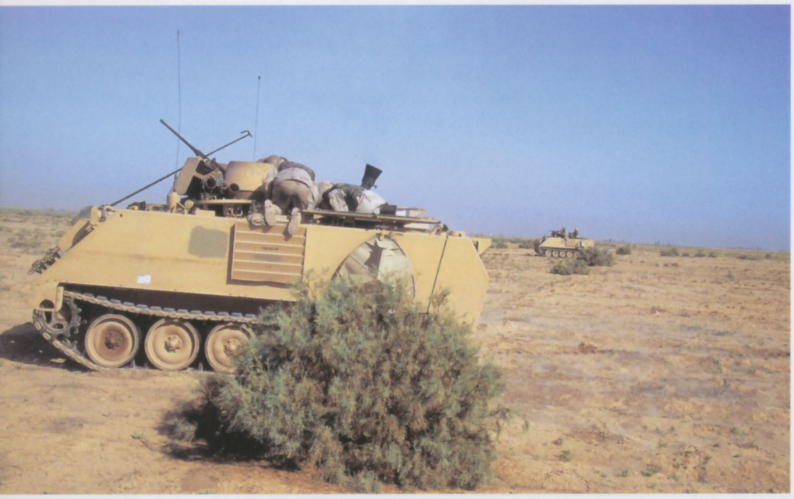
This M1068A3 Standard Integrated Command Post HHC of 1st Brigade, 3rd Infantry Division, was seen at LSAA in July 2005. The M1068A3 is fitted with the Army Tactical Command and Control System. Note the antenna masts stored on the vehicle and the 3rd Infantry Division badge painted on the side of the hull.



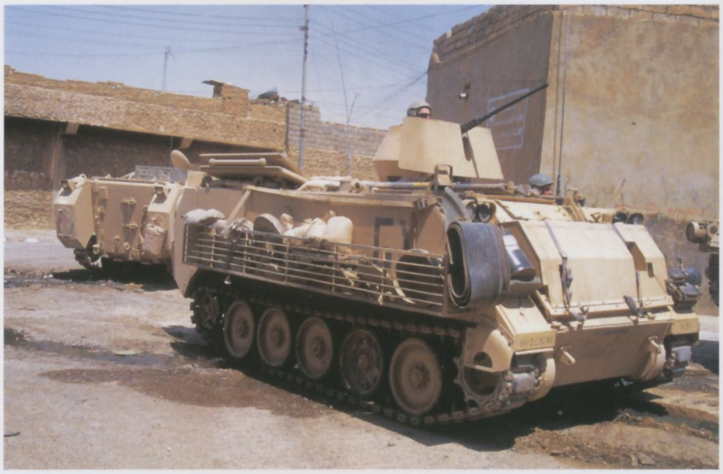
This M1068A3 was used as a Fire Direction Center by 1st Platoon, A Battery, 1st Battalion, 41st Field Artillery Regiment. The vehicle was seen at Camp Summerall near Bayji in July 2005. In view is the new 5kW quiet auxiliary power pack, as well as the new trim vane typical of all A3 versions of the M113 family. Fire missions of the platoon's M109A6 Paladin self-propelled howitzers are coordinated from the rear compartment of this M1068A3. The platoon fired some 550 rounds on enemy positions between February and July of 2005.



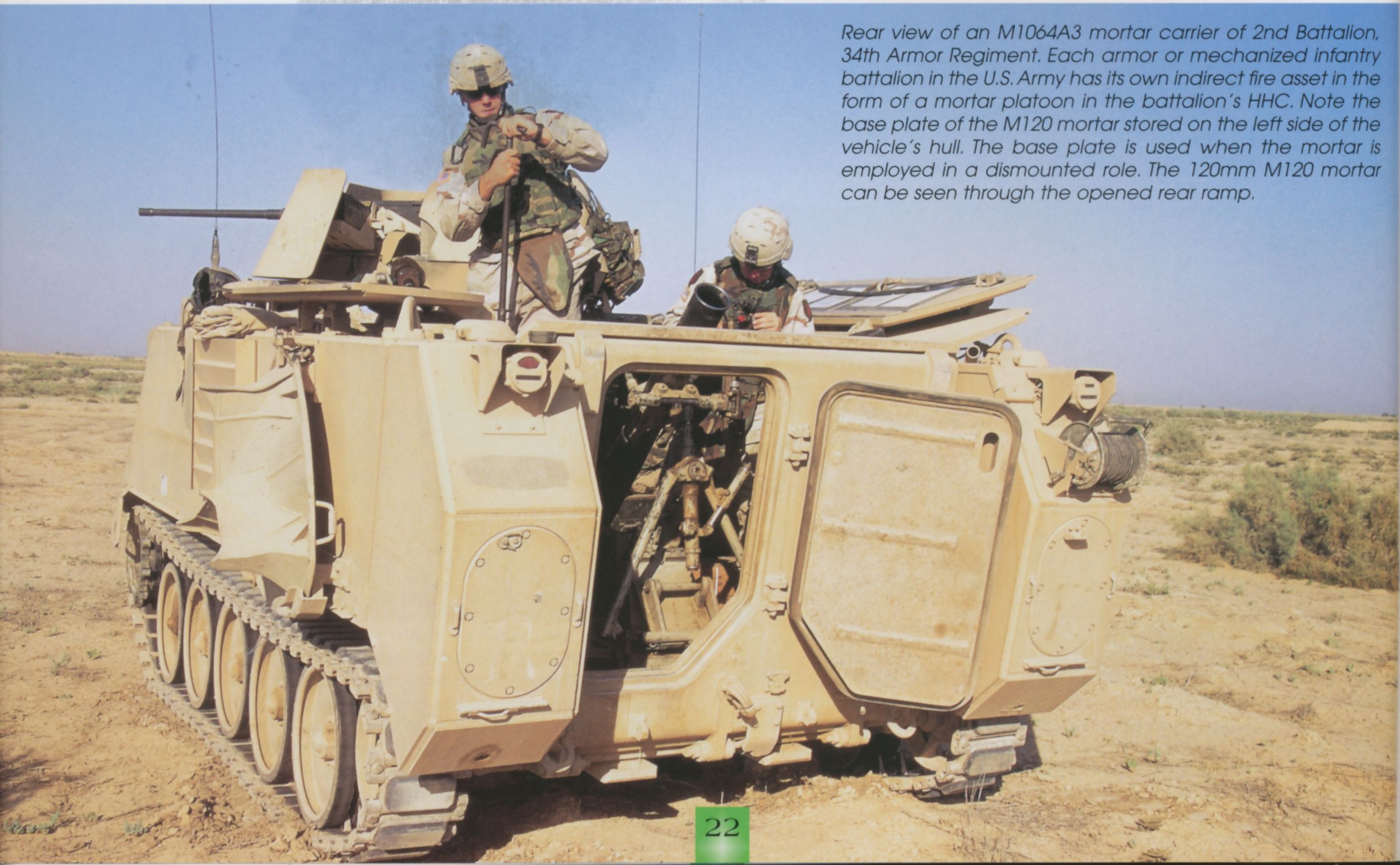
In December 2004 this M577A2 was seen at Camp Victory North, Baghdad. The vehicle belongs to HQ Company, 1st Battalion, 69th Infantry Regiment (Mechanized), of the New York Army National Guard. While upgraded to A2 standard, the welding marks along the hull where the raised superstructure begins identify the vehicle as being one of the first M577s ever produced. In 1962, M113 hulls were converted into the first M577s by welding the raised compartment onto the hull. Note the four-color MERDC camouflage pattern.



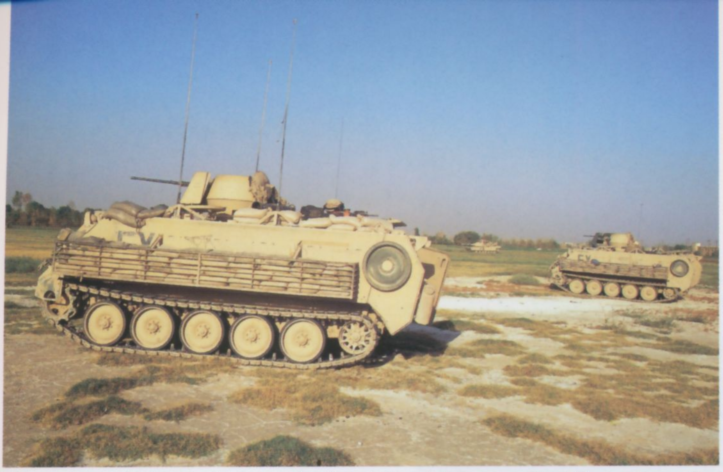
In early August 2005, a 120mm M120 mortar mounted in an M1064A3 mortar carrier engages insurgent positions south of Baqubah. The vehicle belongs to the Mortar Platoon of 2nd Battalion, 34th Armor Regiment "Dreadnaught". A total of sixty-nine 120mm mortar rounds can be stored in racks inside the vehicle.



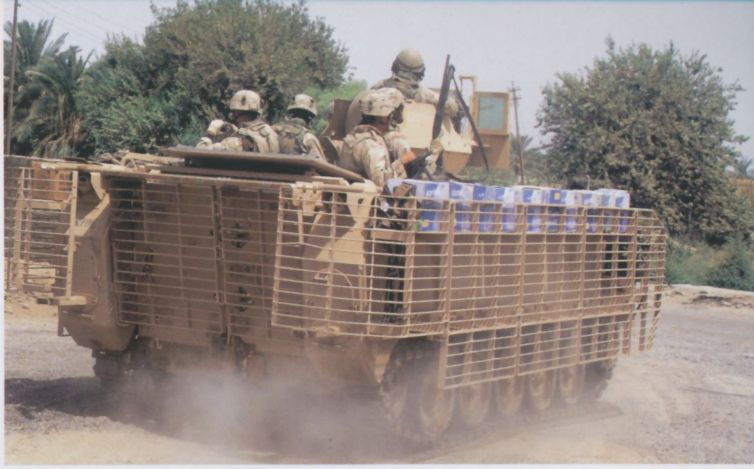
August 2005, this M1064A3 mortar carrier of F Company, 2nd Squadron, 3rd Cavalry Armored Regiment, was seen during a cordon and search operation in Tall Afar. The vehicle is fitted with the ACAV kit and is armed with a 12.7mm M2 HB machine gun. Note the storage rack mounted on the vehicle's side in order to allow the crew to transport additional equipment.



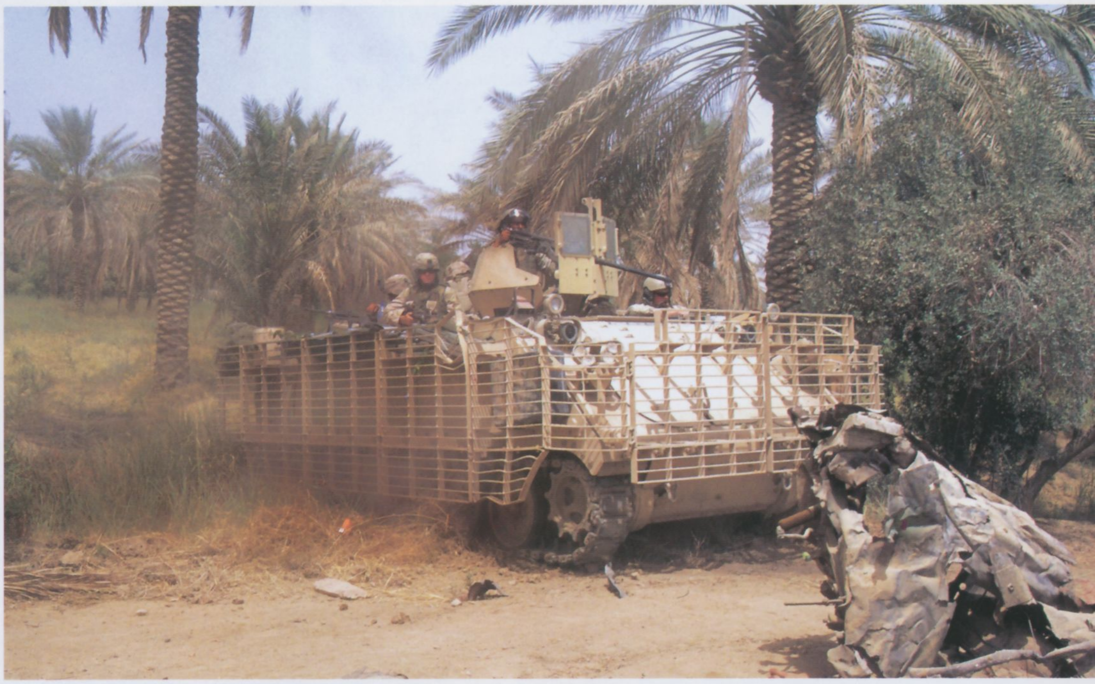
Rear view of an M1064A3 mortar carrier of 2nd Battalion, 34th Armor Regiment. Each armor or mechanized infantry battalion in the U.S. Army has its own indirect fire asset in the form of a mortar platoon in the battalion's HHC. Note the base plate of the M120 mortar stored on the left side of the vehicle's hull. The base plate is used when the mortar is employed in a dismounted role. The 120mm M120 mortar can be seen through the opened rear ramp.



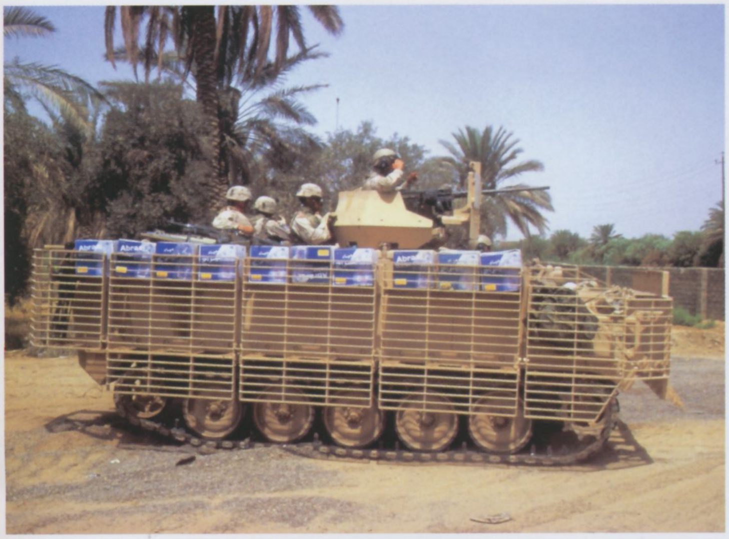
These two M113A3s belong to the HQ of E Troop, 2nd Squadron, 3rd Armored Cavalry Regiment, and were seen during an operation in Tall Afar in August 2005. Note the sandbags placed in the storage rack and on the hull in order to provide additional protection for the crew from the effects of IED and RPG attacks.



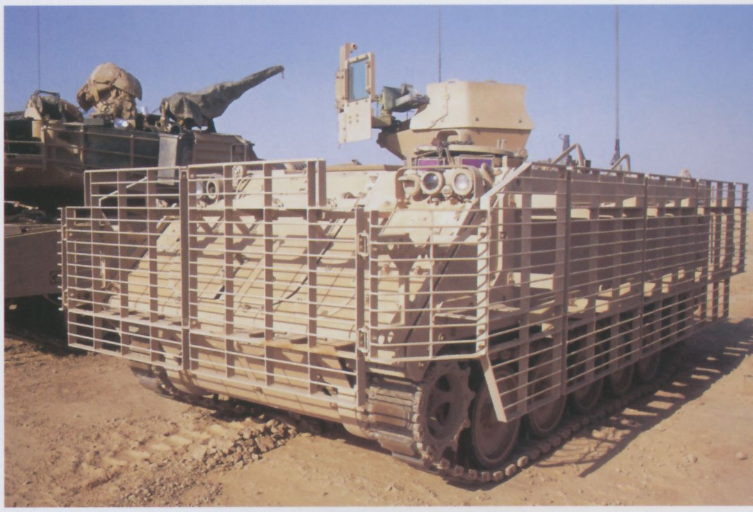
The bar armor of the Add-on Armor Suite also protects the rear of the M113A3. It is bolted to the vehicle's large rear ramp and it is lowered with it when the troops dismount. A small segment of the bar armor placed over the door in the rear ramp can be opened independently in order to allow use of the door. Note the bar armor running around the EFTs.



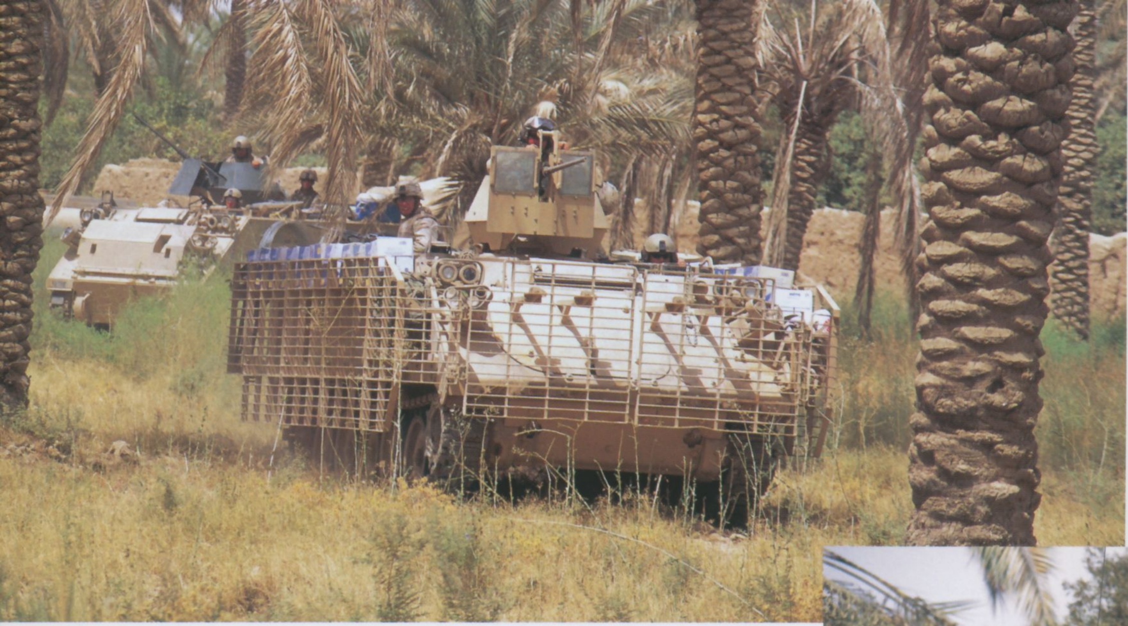
This M113A3 fitted with the Add-on Armor Suite was seen during a counter-insurgency operation north of Taji in July 2005. The vehicle is armed with a 12.7mm M2 HB machine gun. The Transparent Armor Gun Shield is fitted. The Add-on Armor Suite does have unwanted side effects as well - in order to be effective the bar armor has to be mounted at a distance of some 500mm from the hull of the vehicle, but this makes the vehicle harder to maneuver in environments such as narrow streets or in palm tree groves.



Side view of an M113A3 engineer squad vehicle fitted with the Add-on Armor Suite. Visible is the bar armor mounted on the High Hard Appliqué armor. The High Hard Appliqué armor is bolted onto the aluminum armor of the hull. The armor provides 360° protection from 14.5mm rounds, while the bar armor provides a high degree of protection from deadly RPG warheads.

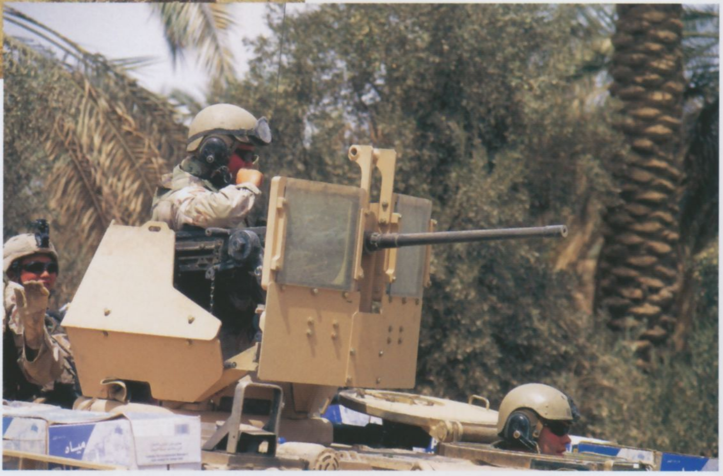


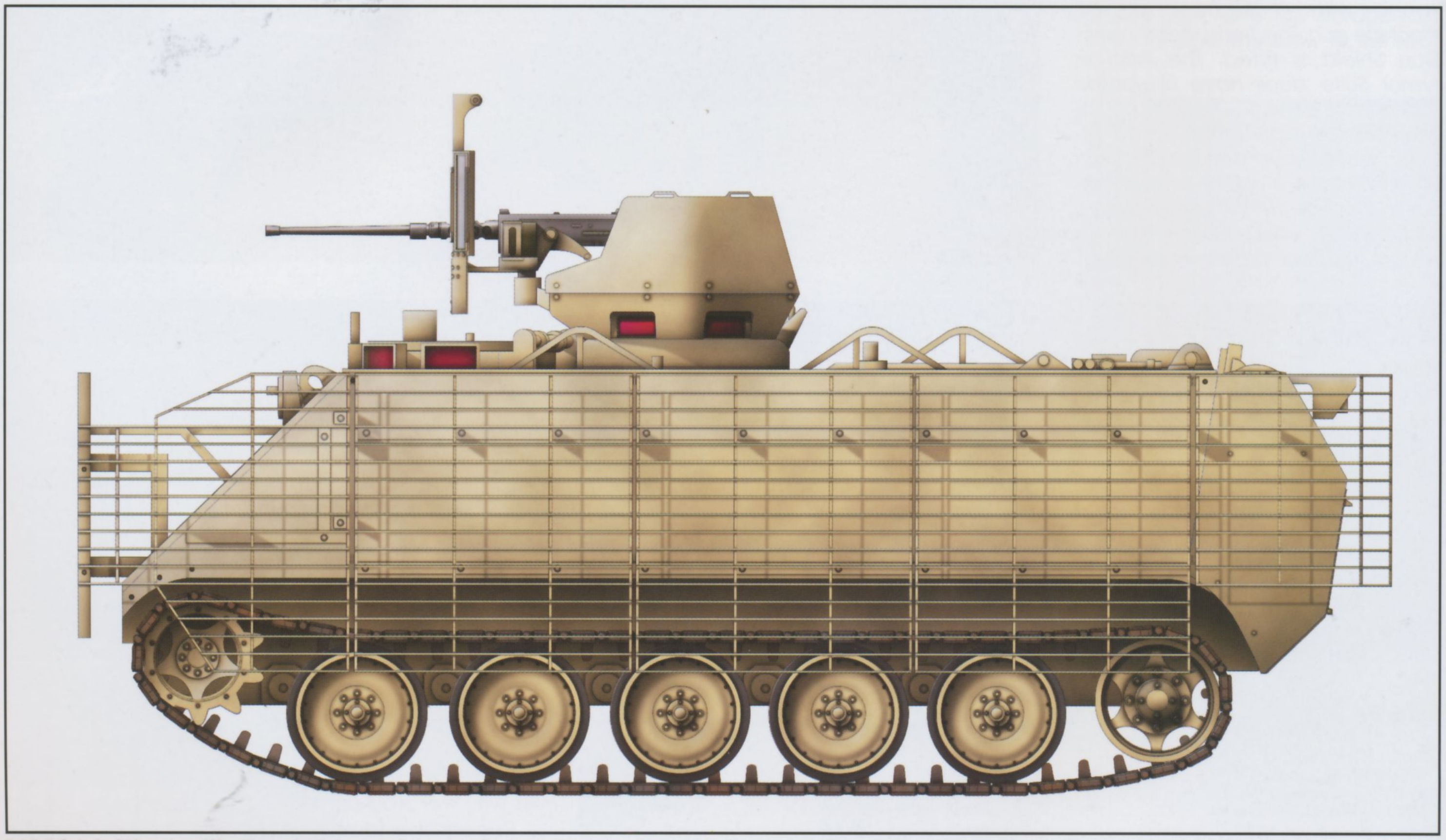
This M113A3 fitted with the Add-on Armor Suite belongs to the 3rd Armored Cavalry Regiment, and was seen at the Tall Afar Air Force Base in northern Iraq. Note the bar armor and the plates of the High Hard Appliqué armor mounted to the sides and front of the vehicle. The commander's cupola is fitted with the TAGS and Cupola Armor. Also visible is the front part of the mine protection system mounted under the hull.



This picture was taken north of Taji along MSR Tampa in late July 2005. While the first M113A3 is already fitted with the new Add-on Armor Suite, the second vehicle still lacks this extra protection. The front-mounted trim vane is removed when the High Hard Appliqué armor and the bar armor are fitted. Note that the TAGS protects almost the complete upper body of the vehicle commander.

Close-up of the TAGS of an M113A3 fitted with the Add-on Armor Suite. The shield provides protection against the effects of 7.62mm ball ammunition, and due to its transparent armor, it improves situational awareness. The shield is mounted to the existing universal mount that can accommodate, as shown here, a 12.7mm M2 HB machine gun, a 40mm Mk.19 Mod.3 automatic grenade launcher, a 5.56mm M249 SAW light machine gun, or a 7.62mm M240B machine gun. Note the Cupola Armor that provides 360° protection for the commander from 7.62mm AP rounds.





M113A3 fitted with the Add-on Armor Suite, 3rd Armored Cavalry Regiment, north of Taji, July 2005

In order to counter the IED and RPG threat, M113A3s deployed to Iraq were fitted with the Add-on Armor Suite. The Add-on Armor Suite consists of bar armor providing 360° protection from RPG attacks, the Transparent Armor Gun Shield providing 7.62mm ball protection to the front for the gunner, Mine Protection providing protection against IEDs and mine blasts under the vehicle's hull, High Hard Appliqué providing protection from 14.5mm rounds, and Cupola Armor providing 360° protection for the commander from 7.62mm AP rounds.

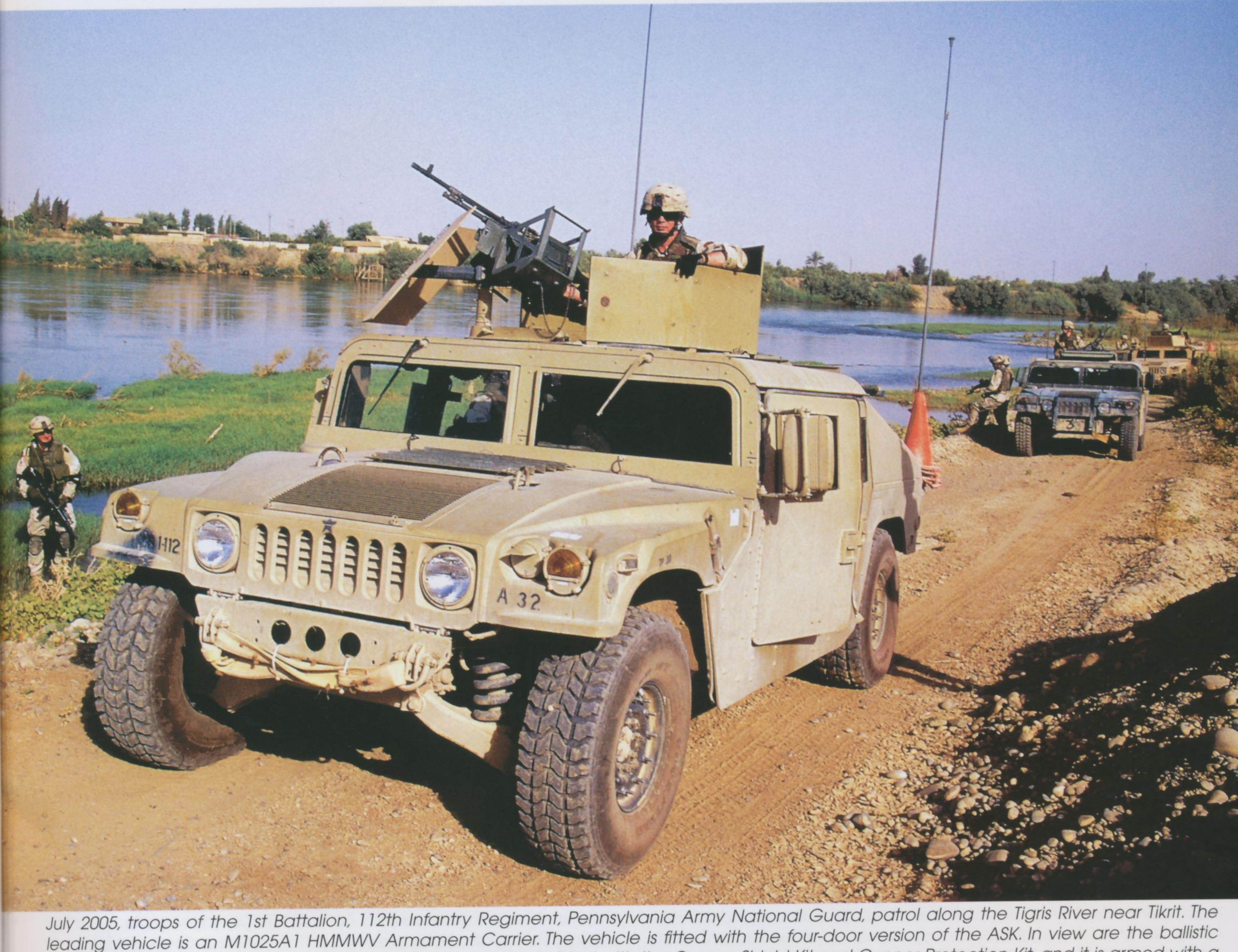
ASK and HArD for HMMWVs

n the early days of the Iraq conflict, most HMMWVs did not feature any armor protection whatsoever. This fact was soon the cause of several U.S. troops being killed during patrols and convoys. In response to this, CENTCOM launched a program to enhance the protection level of the HMMWV M998, M998A1 and M998A2 series of vehicles in the autumn of 2003. Development of the so-called Armor Survivability Kit started at the Research Development and Engineering Command's Tank Automotive Research, Development and Engineering Center, and the Army Research Laboratory in October 2003. Design, development and testing of the ASK took only twenty days! Next, prototype sets were mounted on different HMMWV variants and underwent a 1,650-mile test drive, as well as extensive ballistic testing during which IEDs made from 155mm artillery shells were used. On 13 November 2003, the first fifteen series-production ASK sets were shipped to Iraq. Within two months of development starting, the first vehicles in Iraq were equipped with the new add-on armor package. Production of the ASK was carried out by government fabrication facilities at Anniston Army Depot, Rock Island Arsenal, Red River Army Depot, Lima Army Tank Plant, Sierra Army Depot and Anniston Army Depot.

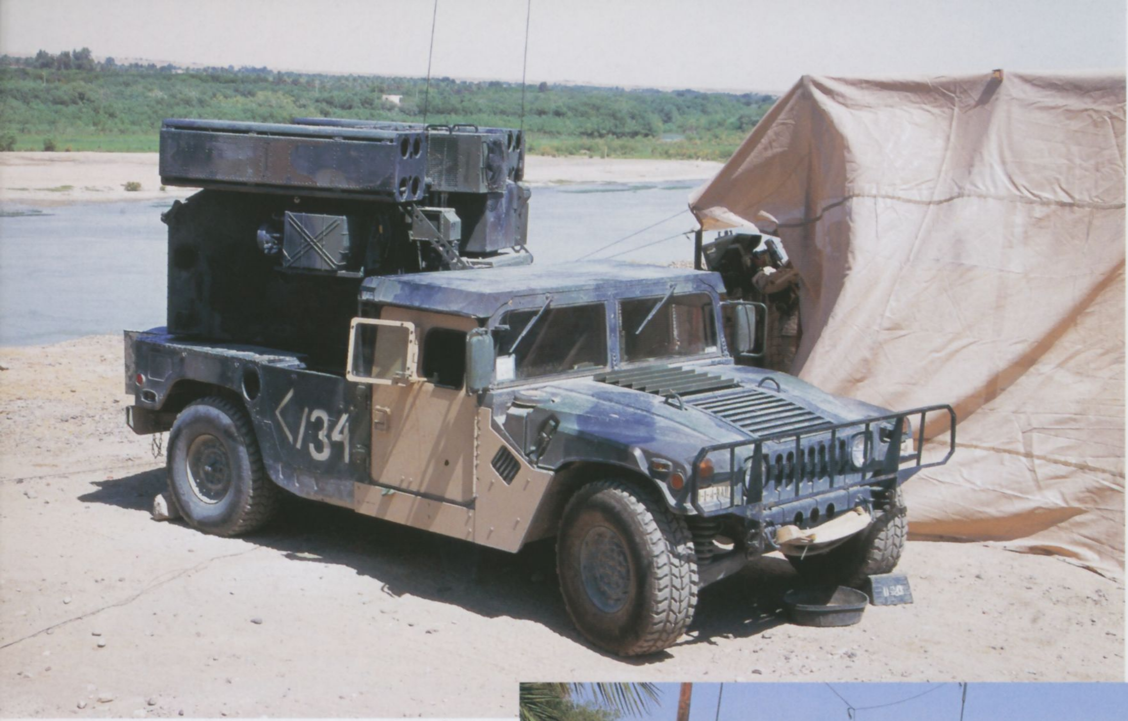
In June 2004, "Stars and Stripes" reported that some 8,000 of the 12,000 soft-skin HMMWVs deployed in-theater had already been fitted with these new armor packages. The ASK is available in one version designed to fit two-door variants of the HMMWV family, while a second version suits four-door variants. The two-door kit weighs 900 pounds, while the four-door kit weighs 1,300 pounds. The kits include armored doors that are fitted as replacements for standard canvas or fiberglass doors. The doors are fitted with ballistic window glass, and feature weather strips designed to keep the elements out. The ASK also includes armored seatbacks, reinforced floor panels, windscreens containing bulletproof glass, heavy-duty latches to withstand the weight of the armored doors, and rocker protection panels. The ASK is made from high-quality steel similar to that used to build modern tanks.

Other armor protection kits for HMMWVs

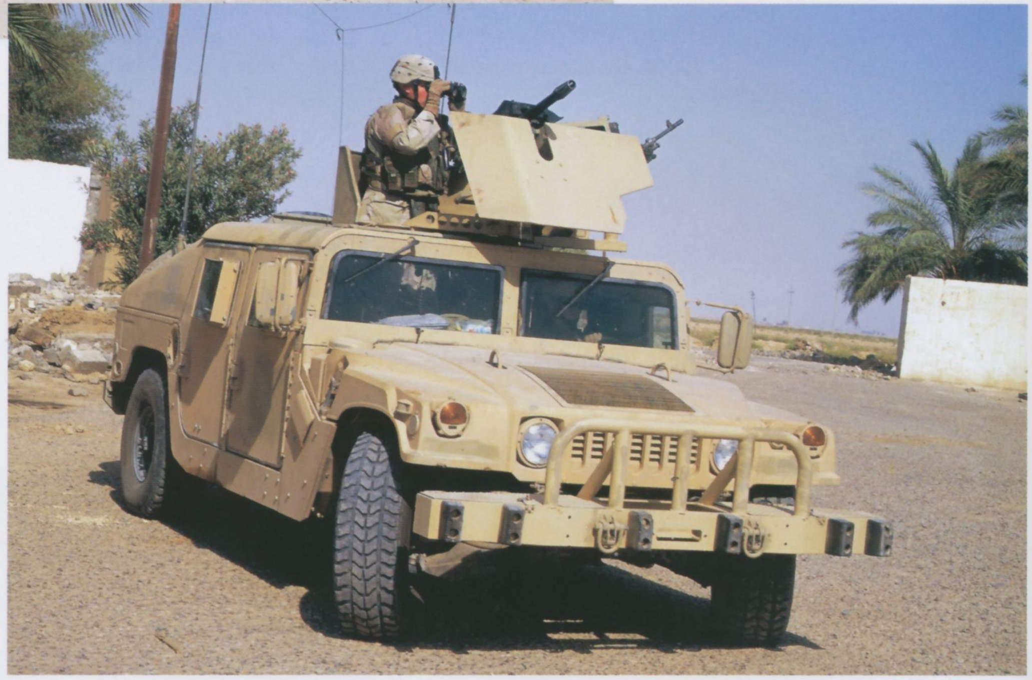
In addition to the ASK, several other off-the-shelf armor kits for the HMMWV were purchased by the U.S. Army and fielded in Iraq. One of these was the HMMWV Armored Demountable Kit (HArD) made by O'Gara-Hess & Eisenhardt, an Armor Holdings Company. The HArD Kit consists of several sub-kits that can be mounted like the ASK on any series of the HMMWV. The complete kit for the four-door version of the HMMWV has a weight of 1,000kg, while the two-door kit weighs in at 700kg. The kits consist of a windscreen made of bulletproof glass, armored floor panels, armored doors and side panels for the chassis, and an armored rear wall, as well as an optional armor-protected roof



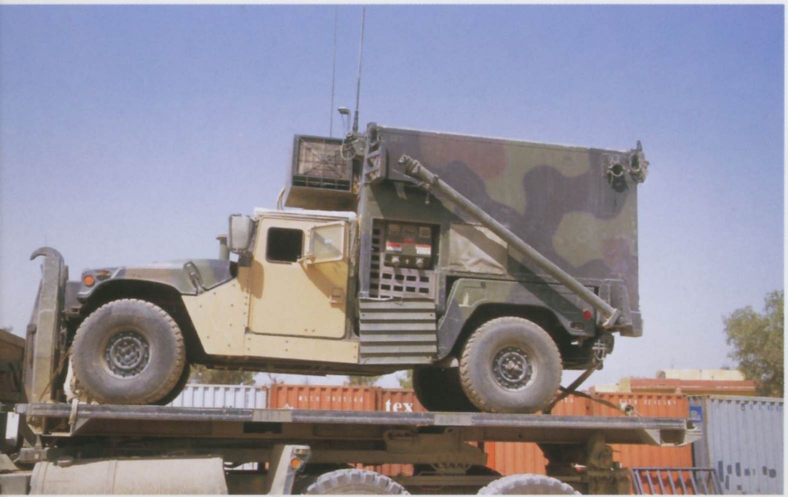
July 2005, troops of the 1st Battalion, 112th Infantry Regiment, Pennsylvania Army National Guard, patrol along the Tigris River near Tikrit. The leading vehicle is an M1025A1 HMMWV Armament Carrier. The vehicle is fitted with the four-door version of the ASK. In view are the ballistic windscreens and the armored doors. Note that this vehicle is fitted with the Gunner Shield Kit and Gunner Protection Kit, and it is armed with a 7.62mm M240B machine gun.



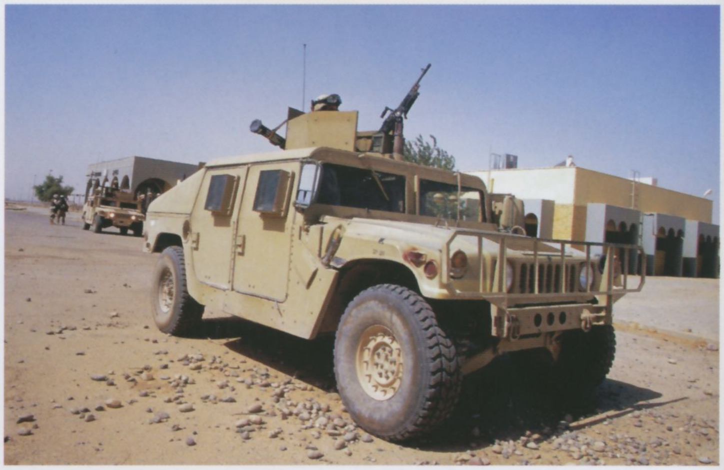
In June 2003 this Avenger air defense missile system of the 4th Battalion, 3rd Air Defense Artillery Regiment, was pictured in Tikrit. The vehicle is fitted with the two-door version of the Armor Survivability Kit (ASK). The ASK adds 900 pounds to the vehicle's combat weight. The Avenger's armament consists of the turret-mounted Stinger SAM launcher and the FN Herstal SA 12.7mm M3P machine gun. Mounted inside the electrically powered turret is the Stinger IFF AN/PPX3B interrogator, CAI optical sight, Magnavox FLIR, DBA automatic video tracker, and Texas Instruments CO? eye-safe laser rangefinder. In Iraq, Avengers are used for base protection as well as for convoy escort duties.



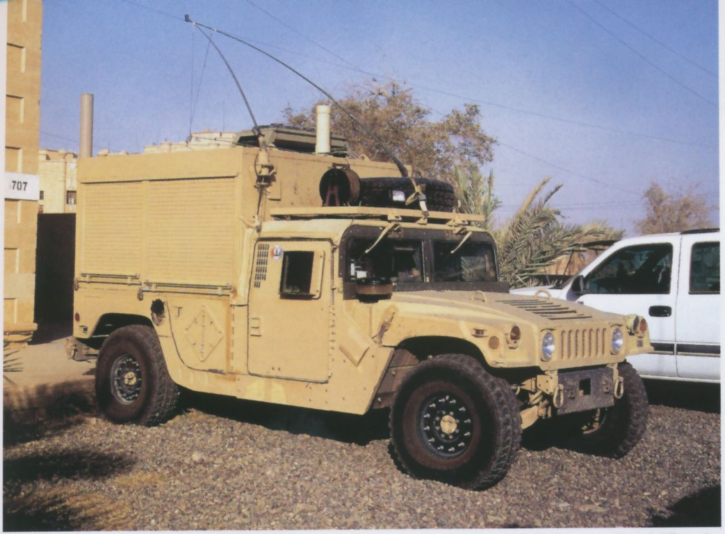
This M1025A1 HMMWV Armament Carrier belongs to the 2nd Battalion, 34th Armor Regiment, and was seen during an operation east of Baqubah in August 2005. The vehicle is armed with a 40mm Mk.19 Mod.3 automatic grenade launcher, and is fitted with the four-door version of the ASK. Note the mounted Gunner Shield Kit and the Front Protection Bumper. The bumper has two integrated lockable storage boxes and the whole assembly weighs 42.3kg.



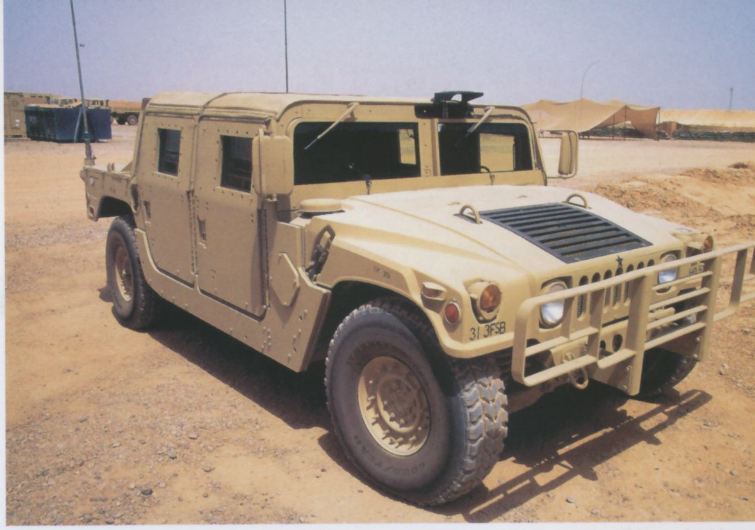
Like other HMMWV versions, the M1113 HMMWV Enhanced Capability Vehicle can be fitted with the ASK. Here the vehicle can be seen in the role of a shelter carrier. The M1113 HMMWV ECV has a gross vehicle weight of 11,500 lbs, and features an enhanced suspension, drive train, and braking systems. As a result, the vehicle's payload is increased to 5,150 lbs.



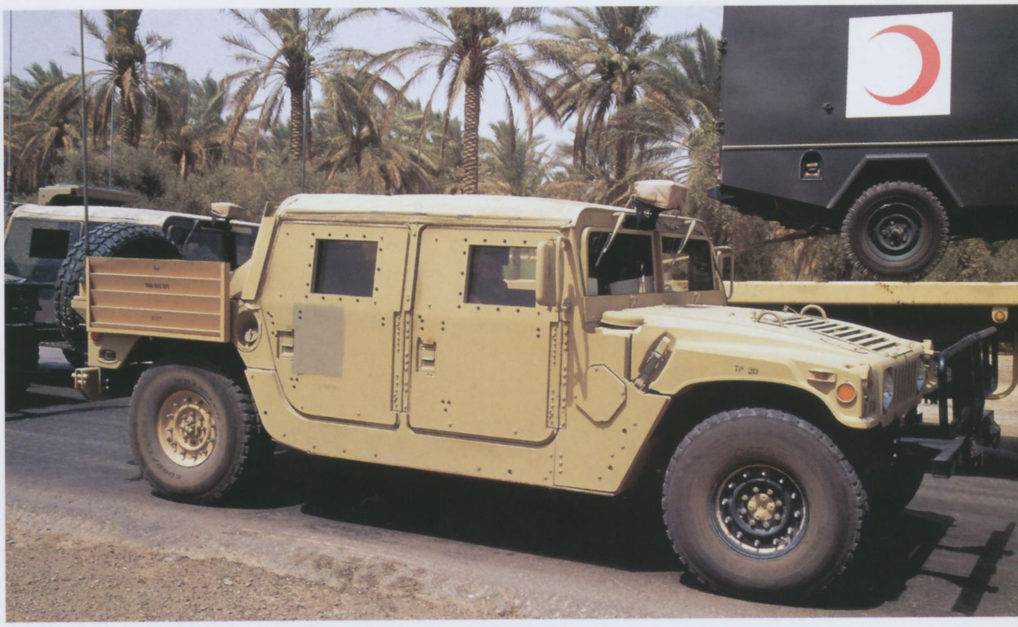
Fitted with an ASK, this M1025 HMMWV Armament Carrier with basic armor belongs to Task Force 1-103. The vehicle was seen at the Bayji Train Station in July 2005. It has the Gunner Protection Kit fitted to the ring mount and is armed with a 7.62mm M240B machine gun. Note the thick ballistic glass of the windows in the vehicle's doors. It is believed that the glass of early production ASK doors was much thinner.



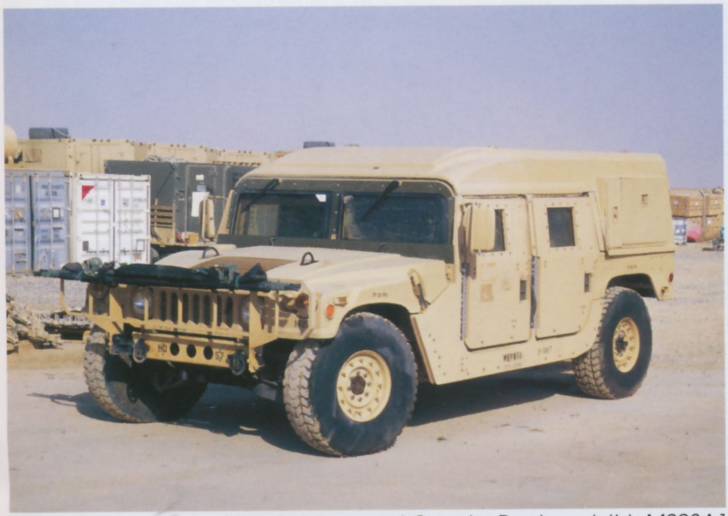
This M1113 HMMWV ECV is carrying a special container called "Body, Explosive Ordnance Disposal, Truck- Mounted". The body is produced by the Rock Island Arsenal and contains all the appropriate kit for an IED team. The kit includes EOD suits and an EOD robot, as well as explosives, various tools, and electronic equipment. The vehicle is fitted with the two-door version of the ASK.



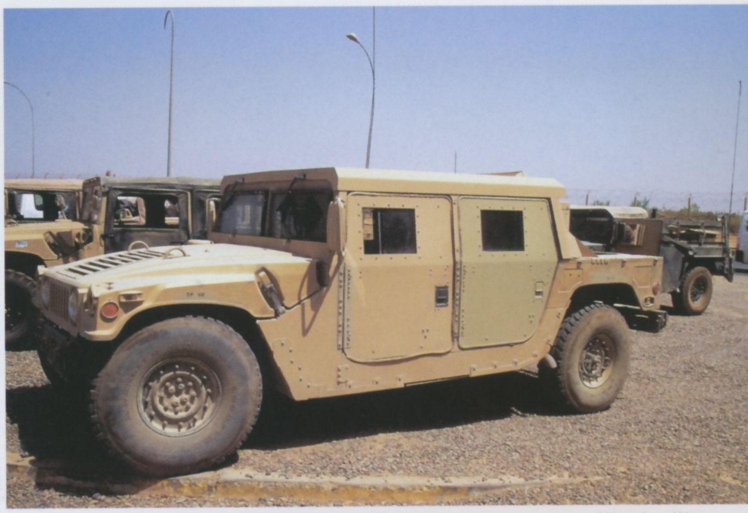
In addition to the ASK, the U.S. Army purchased several off-the-shelf armor kits to help relieve shortages of armor protection kits. This M998A1 Cargo and Troop Carrier is fitted with the HArD Kit. Note that the kit is fitted without the armored roof, a practice commonly seen in Iraq. The vehicle belongs to the 3rd Forward Support Battalion of the 3rd Infantry Division.



This M998A1 HMMWV Cargo and Troop Carrier belongs to the 3rd Forward Support Battalion of the 3rd Infantry Division. The vehicle was seen during a combat logistics patrol north of Taji on MSR Tampa. The vehicle is fitted with the complete HArD Kit, except for the armor-protected roof.



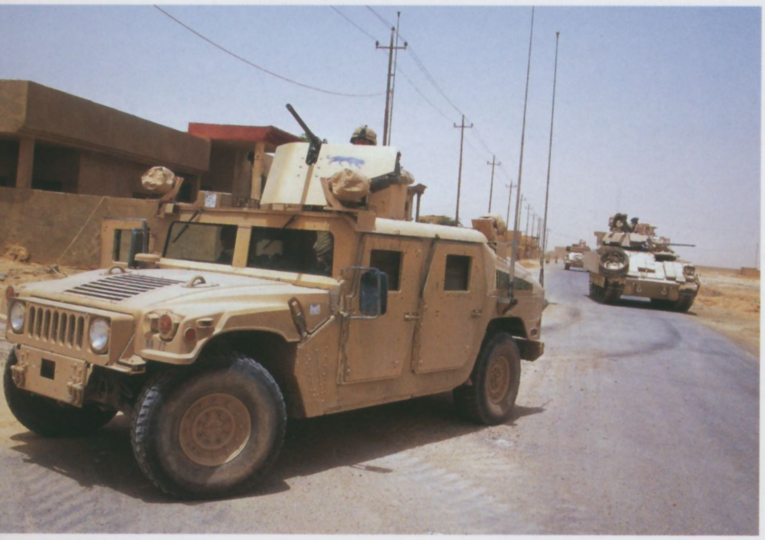
Belonging to a unit of the 3rd Armored Cavalry Regiment, this M998A1 HMMWV Cargo and Troop Carrier has had its soft-top replaced by a Mobile Radio Communications hardtop. The hardtop is not only used by communication assets, but also by maintenance elements, engineers, and so on. The hardtop is popular among the troops as it offers much better protection from the environment than the soft-top. The vehicle is fitted with a HArD Kit.



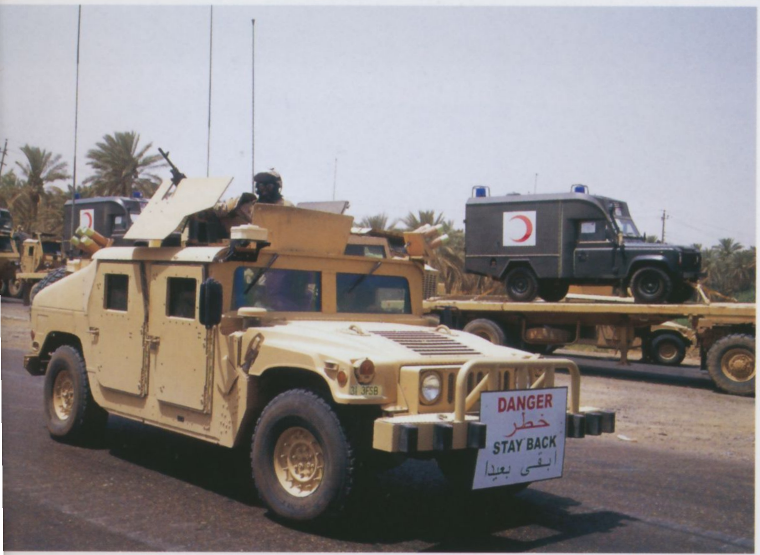
Here an M1097A2 HMMWV Troop Carrier can be seen fitted with a HArD Kit. In this case the armored roof has also been fitted. The kit has a weight of 1,000kg. It also features an air-conditioning system, an essential piece of equipment when an armored vehicle is operating in the hot climate of Iraq. The armor protects the crew against small-arms fire, grenade and mine blasts under the body, as well as splinters from IEDs. The vehicle was seen at LSA Anaconda in July 2005.

M1114 Up-armored HMMWV

Originally the M1114 Up-armored HMMWV entered service in order to provide Military Police units of the U.S. Army with an armor-protected vehicle when operating in high threat areas close to the frontline of a conventional conflict while carrying out typical military police tasks. With the increase in violence throughout Iraq and the growing IED threat, the U.S. Army quickly identified the M1114 Up-armored HMMWV as a solution for the problem of providing a suitable armor-protected vehicle for patrol duties for its troops. M1114 Up-armored HMMWVs were given to armor units, mechanized infantry units, artillery units, transportation units and so on. Often the M1114 Up-armored HMMWVs replaced tracked vehicles such as the M1 Abrams MBT or the M2 Bradley IFV on a one for one basis. In other cases, M1114 HMMWVs were given to units in addition to their heavy equipment. For example, a mechanized infantry platoon received four M1114 Up-armored HMMWVs in addition to its four M2A2ODS Bradley IFVs. In most cases the aim was to provide the units with a wheeled armor-protected patrol vehicle in order to enhance the unit's mobility, flexibility and ability in providing security patrols, without upsetting the local population by constantly driving heavy armor through their crowded streets.

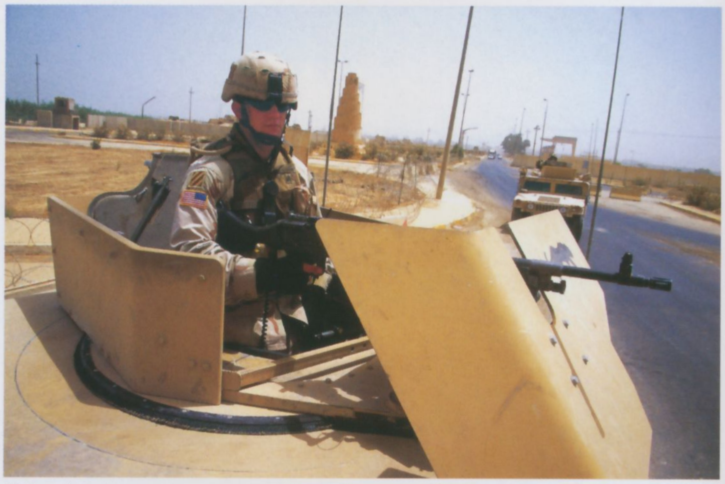


M1114 Up-armored HMMWVs were given to all kinds of units in order to enhance their patrolling capabilities and operational flexibility. This M1114 Up-armored HMMWV belongs to HHC, 3rd Battalion, 69th Armor Regiment, and was seen while on patrol in Samarra in July 2005. The vehicle is fitted with the Light Vehicle Obscuration Smoke System (LVOSS), the Gunner Shield Kit and the Gunner Protection Kit. A 12.7mm M2 HB machine gun is used as the main armament.

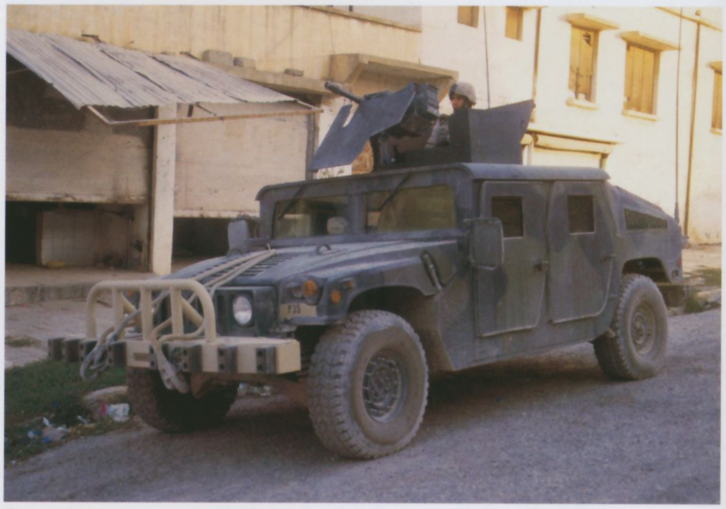


An M1114 Up-armored HMMWV of the 3rd Forward Support Battalion provides security for a combat logistics patrol. The vehicle belongs to the latest production vehicles and features the new doors that are also used on the M1151 HMMWV Enhanced Armament Carrier. Note the Front Protection Bumper, which allows the crew of the vehicle to push obstacles like broken down cars out of the way. The FPB entered service with U.S. Army HMMWVs in larger quantities in 2005. The bumper incorporates two lockable storage boxes and weighs 42.3kg. The vehicle is armed with a 7.62mm M240B machine gun.

The M1114 Up-armored HMMWV is based on the M1113 HMMWV Expanded Capacity Vehicle. The ECV was designed to carry heavier payloads without sacrificing the HMMWV's mobility and load-carrying capability. Development of the ECV was carried out by AM General under a contract with the U.S. Army to provide an HMMWV with a greater payload. Powering the ECV is a General Motors 6.5-liter V8 turbocharged diesel engine with an output of 190hp. Developed from the M998A2 HMMWV, the M1113 ECV features several modifications including modified differentials, an improved suspension system, a modified steering system, and a reinforced frame. The armor kit - including an armored roof assembly, transparent armored glass for the windscreen, complete perimeter armor, and a floor blast protection system - is mounted on the basic structure of the M1113 HMMWV ECV.



This detail picture shows the Gunner Shield Kit and the Gunner Protection Kit from another M1114 HMMWV of the 3rd Battalion, 69th Armor Regiment. Both kits are made by Armor Holdings and are fitted on the ring mount of the vehicle. Together they provide 360° perimeter protection from small-arms fire and the effects of IED splinters for the gunner manning the 7.62mm M240B machine gun.

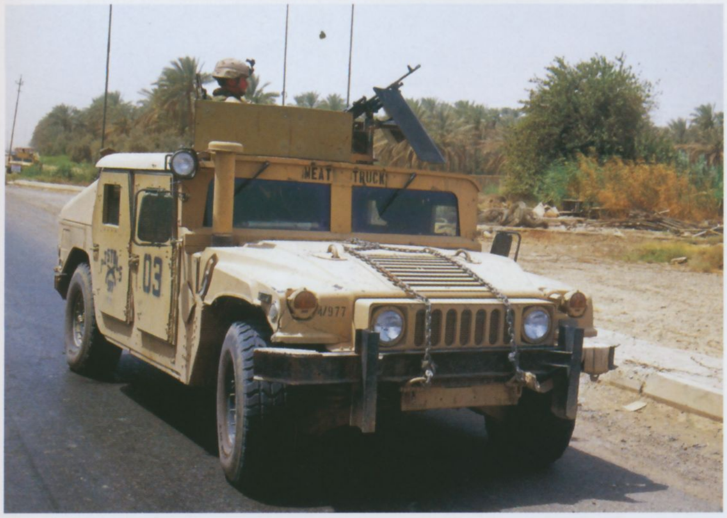


This M1114 Up-armored HMMWV belongs to a Military Police unit assigned to the 3rd Armored Cavalry Regiment, and was seen in Tall Afar in August 2005. The vehicle is armed with a 40mm Mk.19 Mod.3 automatic grenade launcher, and is fitted with the Front Protection Bumper.

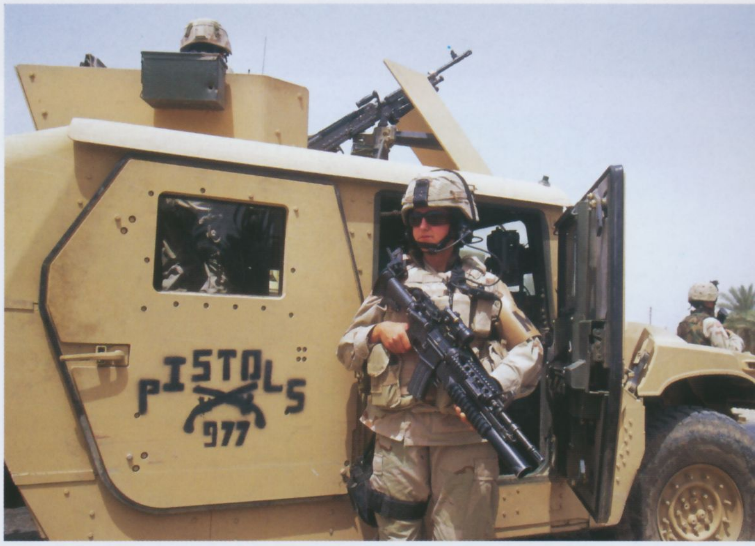
The armor for the M1114 Up-armored HMMWV is made by O'Gara - Hess & Eisenhard, a member of Armor Holdings. According to the manufacturer, the M1114 Up-armored HMMWV protects its crew against the effects of 7.62mm AP ammunition, 155mm splinters from overhead shell bursts and contact-detonated antitank mines up to 6kg in size under the front of the vehicle. Initial development of the M1114 HMMWV began in 1993. Then named the XM1109, the up-armored HMMWV was based on the M1097A1 HMMWV. After type classification, the M1109 went into production and 159 vehicles were produced. The U.S. Army awarded an improvement contract for the M1109 to O'Gara - Hess & Eisenhard in 1994. The improved vehicle was based on the M1113 HMMWV ECV and called XM1114. Series production of the (by then type classified as the M1114) Up-armored HMMWV started in 1996. For the U.S. Air Force, a modified version of the M1114 HMMWV was designed and designated as M1116 Up-armored HMMWV.

When Operation Iraqi Freedom commenced, the U.S. Army and U.S. Air Force operated some 1,800 M1114 and M1116 Up-armored HMMWVs. CENTCOM estimated that in Iraq and in Afghanistan a total number of 1,000 M1114 HMMWVs would be required. They soon realized that this number was totally insufficient, as the security situation in Iraq quickly evolved into a violent guerilla war. In late 2003, in a revised requirement statement, the number of vehicles needed was raised to 2,500 M1114 Up-armored HMMWVs. In May 2004, the U.S. Senate approved US$618 million for the production of 9,600 additional M1114 HMMWVs. Several orders for even more vehicles followed later.

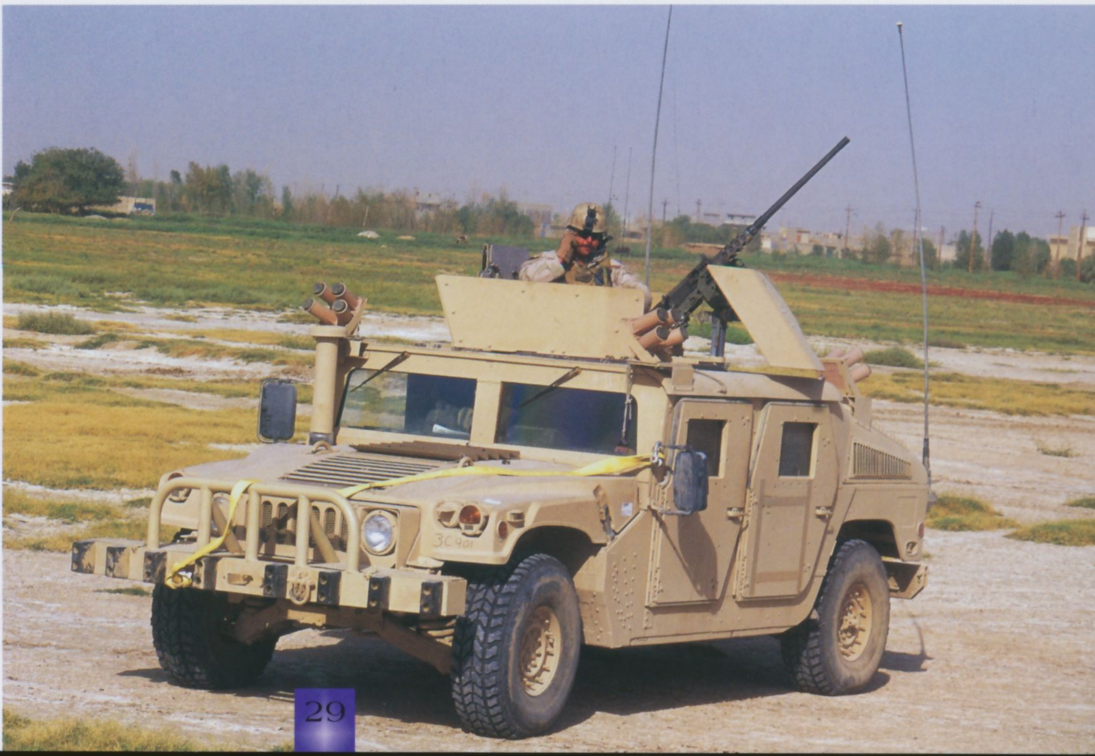
In May 2004, monthly production of M1114 Up-armored HMMWVs was 300 vehicles. By October 2004 this had increased to 450 vehicles, and in the following months this was raised even further. In 2004 some 7,000 M1114 HMMWVs were delivered to U.S. forces, followed by some 8,000 in 2005. In 2005, in addition to the M1114 HMMWV, the new M1151 HMMWV Enhanced Armament Carrier and the M1152 HMMWV Troop/Cargo/Shelter Carrier went into series production. These vehicles, like the M1114, are based on the M1113 HMMWV ECV and feature armor protection. The big difference is that the M1151 and M1152 will be armored to specified levels in the production process, and that armor packages able to be quickly installed and removed by the vehicle crew according to the threat level, are delivered with the vehicles.



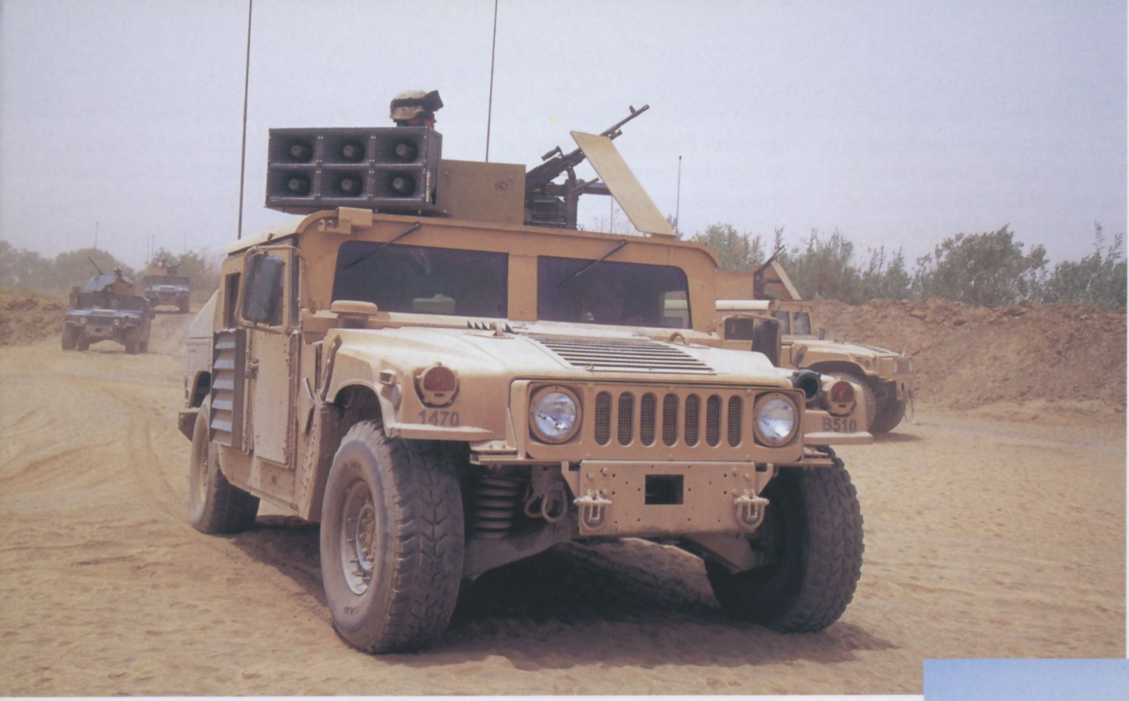
This M1114 Up-armored HMMWV belongs to the 977th Military Police Company "Pistols", and was seen on MSR Tampa near Taji in July 2005. The vehicle is fitted with a Gunner Shield Kit and perimeter protection for the gunner, as well as a front bumper made at the unit level. The vehicle is armed with a 7.62mm M240B machine gun.



Detail picture of the side doors of the same HMMWV. In view are the new doors of the M1151 HMMWV Enhanced Armament Carrier. The doors feature a modular armor system and can be identified by the square cutout area around the handles. The crew can decide, according to the threat level, if they want to have the armor fitted as in the picture or removed. Note the badge of the 977th Military Police Company "Pistols" from Fort Riley, Kansas, painted on the vehicle.

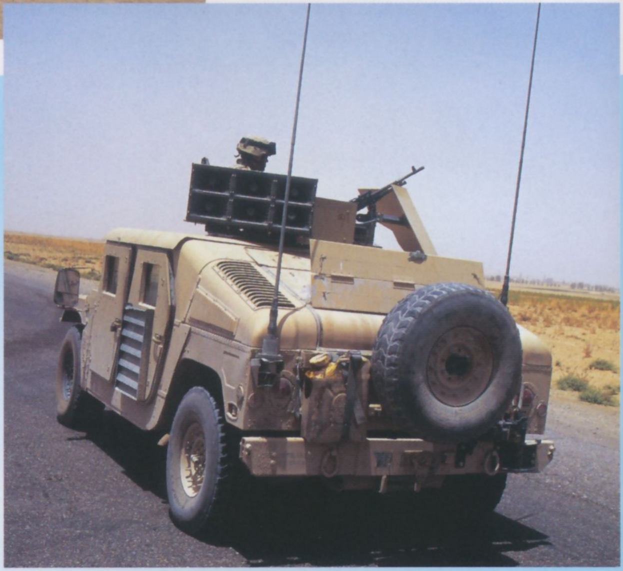


7 August 2005 - along with troops of the 3rd Iraqi Army Division, U.S. Special Forces of the 3rd Special Forces Group arrive in Tall Afar. The Special Forces use late production M1114 HMMWVs featuring the doors of the M1151 HMMWV Enhanced Armament Carrier instead of the commonly used Ground Mobility Vehicle - Special Forces. The vehicle is armed with a 12.7mm M2 HB heavy machine gun and is fitted with the LVOSS (Light Vehicle Obscuration Smoke System).



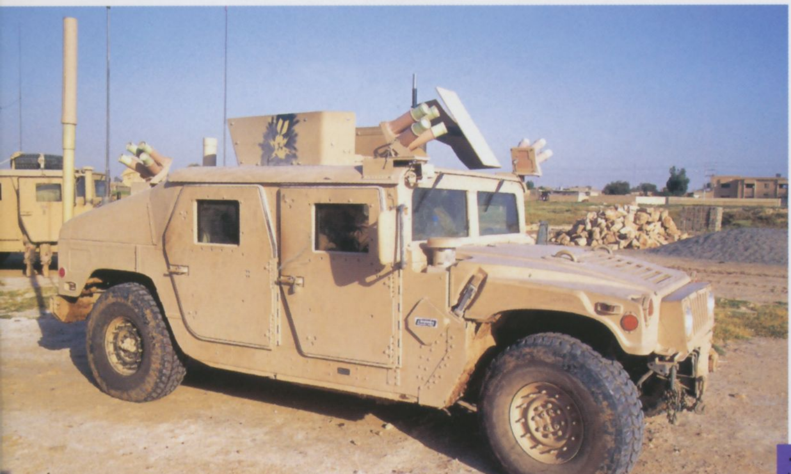
This M1114 Up-armored HMMWV belongs to a Psychological Operations unit and was seen near Tikrit in July 2005. The vehicle is armed with a 7.62mm M240B machine gun, and is fitted with an AEM 700/900 loudspeaker system. The AEM 700/900 is capable of broadcasting messages out to a range of 1,800 meters.

Rear view of the same M1114 HMMWV used by a Psychological Operations unit. Note the ballistic shield on the large rear cargo hatch of the vehicle; it is nicknamed a "Don't shoot me panel" by the troops. It prevents bullets from ricocheting and traveling up under the Gunner Shield Kit.



Technical Data for M1114 Up-Armored HMMWV

Engine:	General Motors 6.5-liter V8 turbocharged diesel, EPA compliant, developing 190hp at 3,400rpm
Maximum road speed:	125km/h
Curb weight:	4,447kg
Payload:	1,043kg
Gross vehicle weight:	5,490kg
Maximum towed load:	1,906kg
Fuel tank capacity:	94 liters
Seating capacity:	1+3
Length:	4.99m
Width:	2.30m
Height:	1.90m
Track width:	1.82m
Wheelbase:	3.30m
Ground clearance:	300mm
Turning radius:	7.62m
Angle of approach:	46.5°
Angle of departure:	33.5°
Acceleration:	0 - 48km/h in 6.96 seconds; 0 - 80km/h in 26.1 seconds
Cruising range:	443km
Fording:	770mm, or 1.52m with extra kit
Transmission:	General Motors 4L 80E 4-speed automatic-type transmission with a maximum input torque rating of 451 lb/ft.
Wheels and tires:	16.5x 8.25 wheel with 1,747kg capacity. Tires are 37x 12.5 R16.5 LT load range "D" radial with low-profile run-flat device on two-piece take-apart wheel. Flat-run capability is 48km
Suspension:	Independent double A-frame with open-end coil springs and hydraulic shock absorbers.
Brakes:	Hydraulically actuated, four-wheel inboard-mounted power disc brakes with dual reservoir master cylinder



This M1114 Up-armored HMMWV is being used by a U.S. Army EOD team and was seen in Tall Afar in August 2005. The vehicle belongs to the latest production runs and features the M1151 HMMWV Enhanced Armament Carrier doors. The vehicle is fitted with two different IED countermeasure devices and the LVOSS. The "Warlock" electronic countermeasure system emits frequencies used by mobile phones and other electronic devices regularly employed to detonate IEDs.

Common Remotely Operated Weapon Stations

A large proportion of the U.S. troops killed in Iraq are gunners manning their roof-mounted heavy weapons of M1114 Up-armored HMMWVs or other vehicles. They are victims of IEDs or are killed by small-arms fire when their vehicles are ambushed. As a first step in protecting these gunners, most vehicles were fitted with gunner protection kits, basically boxes made of steel armor providing ballistic protection. As a second step, an option to get the gunner moved down from the roof into the protected cab of the vehicle was researched. Along with improved surveillance and target acquisition capabilities, as well as a high degree of accuracy, a solution was found in the Common Remotely Operated Weapon Station, or in short, CROWS.

The Common Remotely Operated Weapon Station

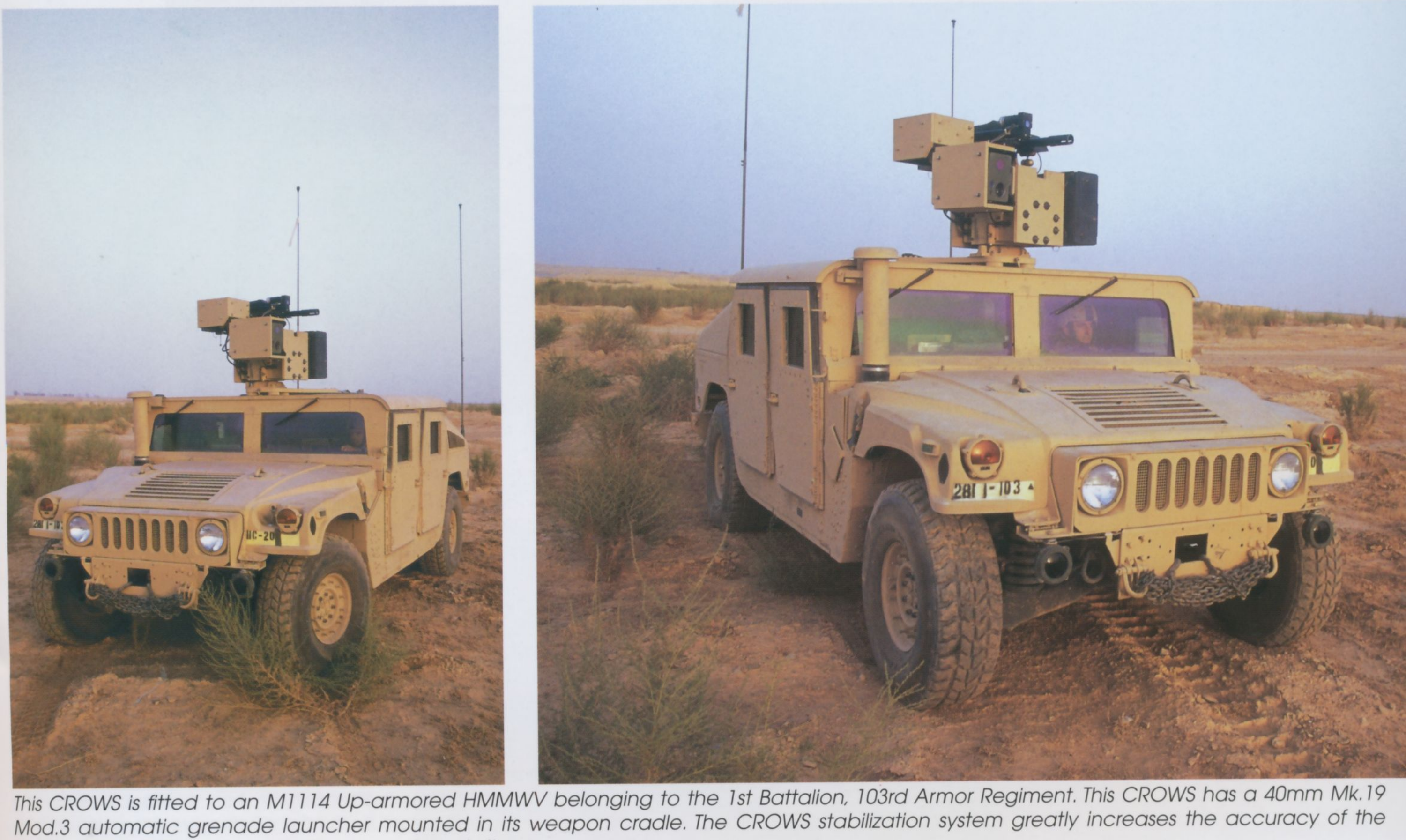
Designed by Recon Optical Incorporated, Illinois, the Common Remotely Operated Weapon Station can be mounted on M1114 Up-armored HMMWVs, as well as several other tactical vehicles. CROWS is mounted on the vehicle roof instead of the vehicle's weapon ring mount. The operator's terminal, in the case of an M1114 HMMWV, is installed in front of the rear passenger seat on the driver's side. Mounting CROWS on an M1114 HMMWV takes between six and eight hours. CROWS consists of the Electro-Optical Fire Control System with Laser Rangefinder, the operator display mount, the weapon mount, the operator interface, a movable joystick, and a set of connecting cables. The EFCS Sensor features a second-generation FLIR camera and a powerful color day camera. In the electrically operated weapon mount of CROWS, the 12.7mm M2 HB heavy machine gun, the 7.62mm M240B machine gun, or the 5.56mm M249 SAW light machine gun, can be mounted. In addition to the machine guns, the mount can also house the 40mm Mk.19 Mod.3 automatic grenade launcher.

The lethality and operational range of the weapons is increased when used with CROWS. The reason for this is that the CROWS weapon mount consists of a dual-axis stabilization system, plus an integrated electronic fire control system. Once laid on a target, the electronic fire control system adjusts the laying of the gun while taking into account both the distance and the ballistic data of the weapon and its ammunition. With CROWS the first round hit probability is increased, while target acquisition, tracking and engaging is now possible while the vehicle is on the move. In the event that the electrical firing device of CROWS has a malfunction, the weapon can still be operated manually; however, this forces the gunner to open the roof hatch and expose himself to possible enemy fire.

CROWS fielding

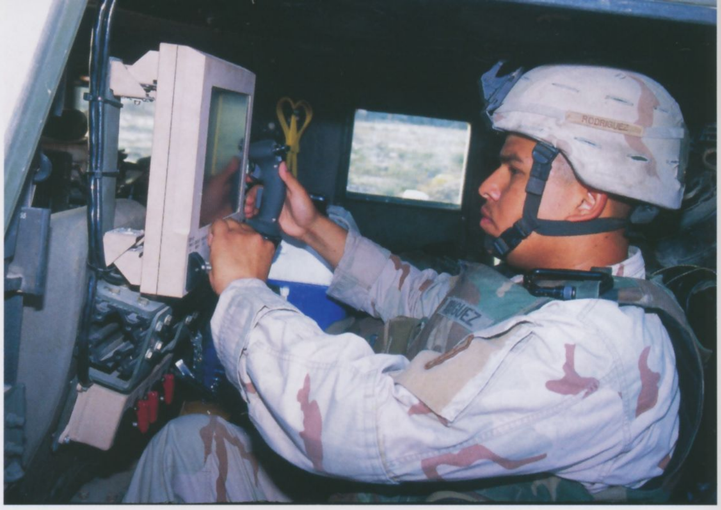
While the development of CROWS dates back several years, the U.S Army did a first assessment of CROWS around July 2002. Then the system was mounted on an M1117 Guardian ASV of the Military Police. The assessment was followed by four months of development testing beginning in October 2002. During this time, several performance tests were conducted. One such test was done with a 12.7mm M2 HB heavy machine gun. During the test, 2,000 rounds were fired by a CROWS-mounted M2 HB zeroed at a distance of 300m. The target size was 18x20 inches and it was situated at a distance of 1,000m. A 70% hit rate was achieved. Field trials of an initial batch of four CROWS prototypes were conducted in Iraq beginning in December 2003.

Recon Optical Incorporated received the first order for a total of twenty-seven CROWS on 24 November 2004. Deliveries began a month later. The quick acquisition of the initial systems was based on an "urgent operational needs statement" sent to the Pentagon by the Crew Served Weapons branch of the Picatinny Arsenal. The Pentagon responded with an "urgent material release", and CROWs was classified as an operational test item and given the designation XM101. Another 252 CROWS were ordered by the U.S. Army on 15 March 2005, bringing the total number of systems on order to 279. Delivery of these started in July 2005. The contracts (worth about US$87.1 million) include field service support and spare part kits, as well as depot-level maintenance support. Currently it is expected that the latest order of CROWS will all be delivered to units deployed in Iraq in the early spring of 2006.



This CROWS is fitted to an M1114 Up-armored HMMWV belonging to the 1st Battalion, 103rd Armor Regiment. This CROWS has a 40mm Mk.19 Mod.3 automatic grenade launcher mounted in its weapon cradle. The CROWS stabilization system greatly increases the accuracy of the installed weapon while on the move or when stationary.

Fielding is done centrally by the CROWS Fielding Center based at LSAA. It is also here that CROWS operators go through a two-week CROWS certification course. Originally designed for use by Military Police units, CROWS is currently fielded by a variety of units. Systems were seen in use with the 1st Battalion, 103rd Armor Regiment, based at FOB Summerall near Bayji; the 3rd Squadron, 278th Armored Cavalry Regiment, based at FOB Cobra near Jalula; and the 2nd Battalion, 8th Field Artillery Regiment, based at FOB Q-West near Al-Qayyarah. Regarding the numbers of CROWS fielded per unit, the aforementioned artillery unit received a total of five CROWS. With its stabilized remote operation, CROWS protects U.S. soldiers in Iraq by enabling gunners to operate safely from within their vehicle's ballistic protection. The soldiers are no longer exposed to hostile fire, inclement weather, or other hazardous conditions normally associated with operating overhead weapon stations. The system's stabilization greatly increases the accuracy of the installed weapons while on the move or when stationary. The accuracy of CROWS-mounted weapons multiplies force effectiveness, lowers collateral damage potential, and reduces the number of required ammunition rounds to hit a target.



The operator's terminal, in the case of this M1114 HMMWV, is installed in front of the rear passenger's seat on the driver's side. In this picture, the operator display mount, the operator interface, and the movable joystick can be seen.

Technical Data for CROWS

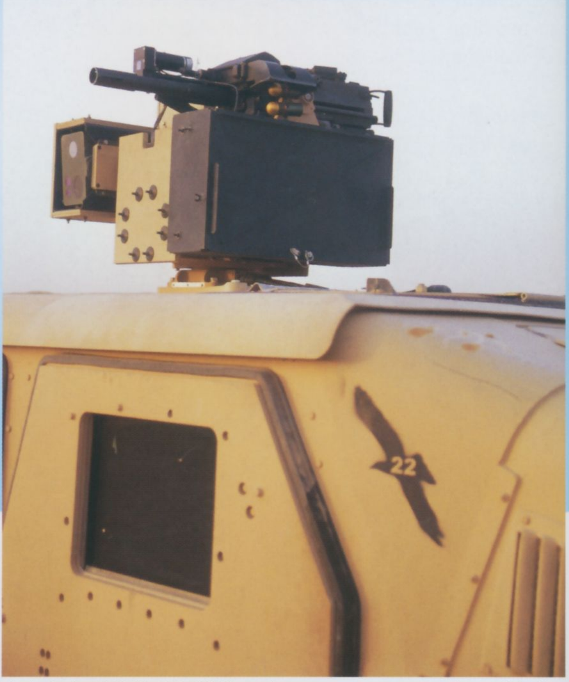
Manufacturer:	Recon Optical Incorporated, Illinois. This company teamed up with Fire Control Systems and Electronic Optic Systems Technologies, Arizona.
Mount:	Multi-weapon cradle that can be fitted with 7.62mm M240B, 5.56mm M249 SAW, or 12.7mm M2 HB machine guns, as well as the 40mm Mk.19 Mod.3 automatic grenade launcher
Ready ammunition:	2,000 rounds of 5.56mm or 7.62mm, 500 rounds of 12.7mm, and 96 40mm grenade rounds
Traverse:	360°
Elevation:	-20° to +60°
Elevation rate:	60° per second
Azimuth rate:	90° per second
Height:	30 inches from vehicle rooftop to top of CROWS
Weight:	450lbs.
Laser rangefinder accuracy:	+/- 10m at 5,000m

Technical data for Night Sight:

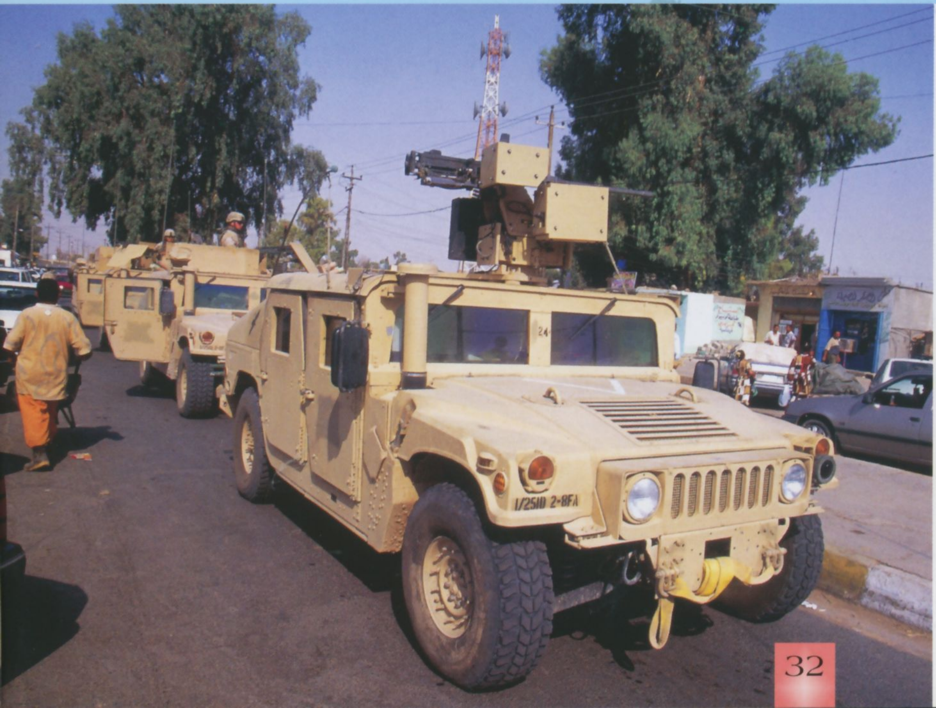
Recognition range:	2,200m
Field of view:	wide 9°x54°, narrow 3°x18°
Spectral range:	3-5 um

Technical data for Day Sensor:

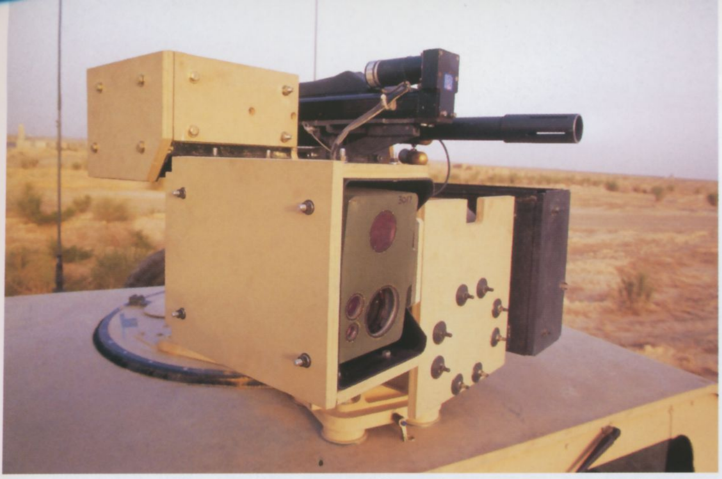
Identification range:	2,200m
Field of view:	1.1°x28.8°
Focal length:	9.5mm to 26.5mm
Magnification:	0.5x to 8.5x

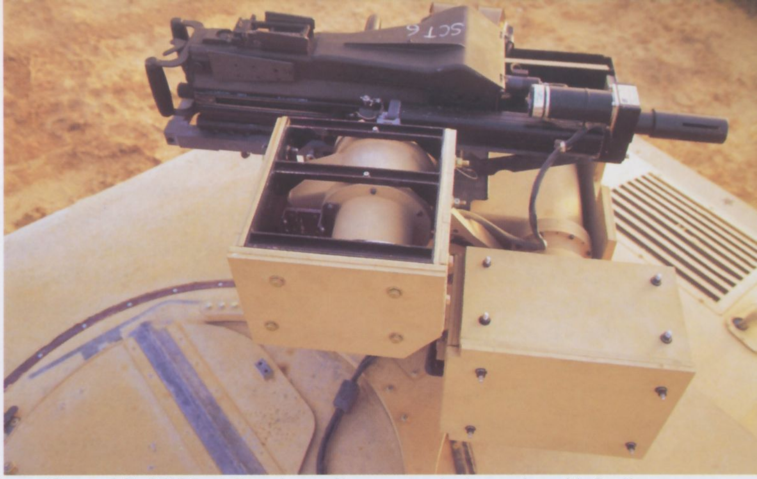


A total of 279 CROWS systems were on order with the U.S. Army by 2005. Mounting of the system is done in a facility at LSA Anaconda run by Recon Optical Incorporated. The marking of the crow with the number "22" identifies the system as being the twenty-second one to be delivered and mounted in Iraq.

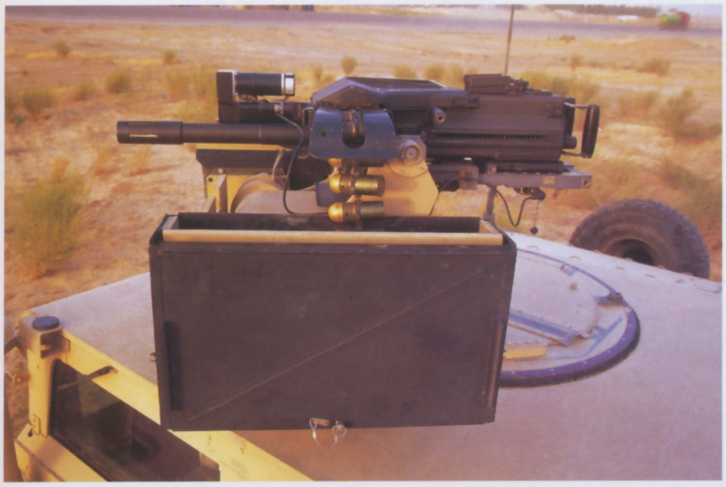


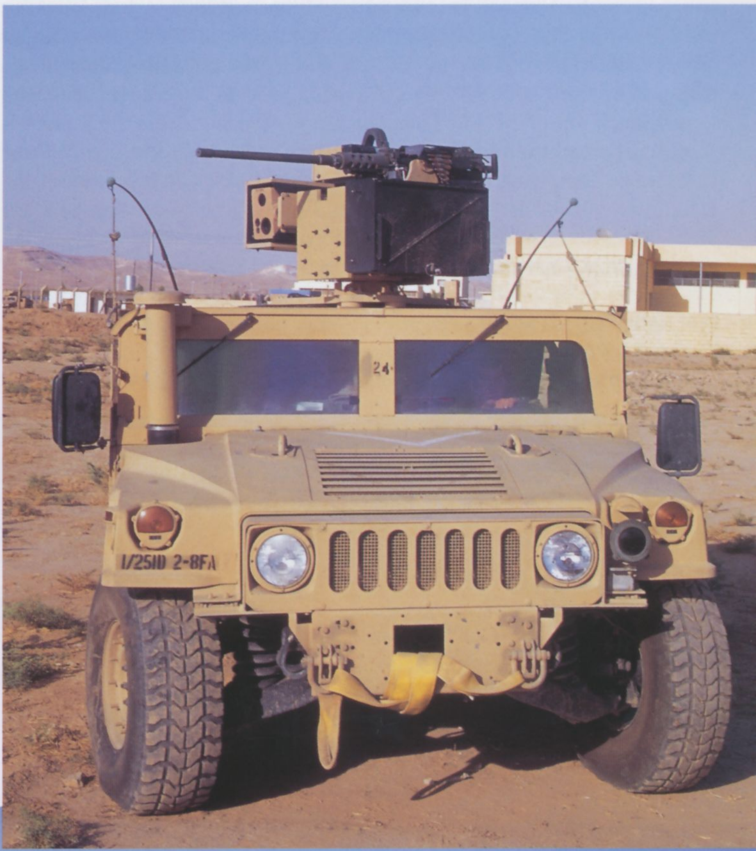
Old and new - visible is the impact that CROWS has on the gunner's security. The first M1114 Up-armored HMMWV is fitted with CROWS, with the gunner sitting well protected inside the vehicle's armored hull. The second vehicle is not fitted with CROWS, so the gunner is exposed to the environment and all sorts of enemy fire; an inviting target for a skilled sniper. The picture was taken in Qayyarah, northern Iraq, in August 2005. The vehicle belongs to the 2nd Battalion, 8th Field Artillery Regiment.



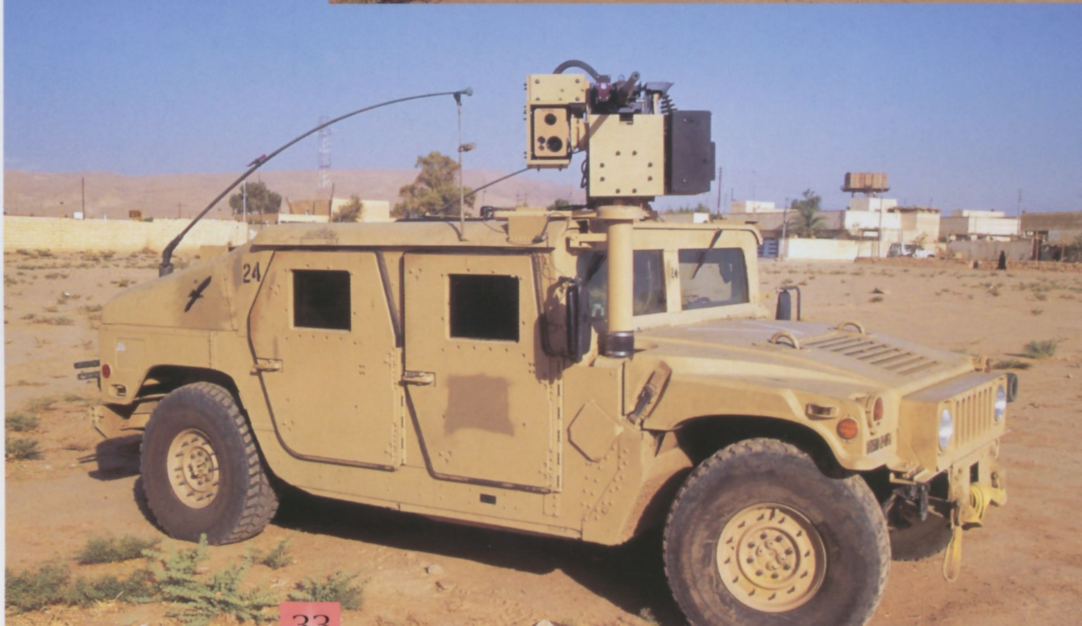


CROWS can be fitted with several different weapons, and in this case it is a 40mm Mk.19 Mod.3 automatic grenade launcher. Note the armor plates that protect the azimuth drive, elevation drive and electronics of the remote weapons station, as well as the Electro-Optical Fire Control System. These plates guard against damage from enemy fire and splinters. Visible is the large ammo box that can hold ninety-six rounds of 40mm ammunition.





This M1114 Up-armored HMMWV belongs to the 2nd Battalion, 8th Field Artillery Regiment, of the 1st Brigade, 25th Infantry Division. The vehicle is fitted with CROWS, and in the weapon station a 12.7mm M2 HB is mounted. CROWS can be traversed continuously for 360°, while the elevation ranges from −20° to +60°. To prevent blue-on-blue contact, no-fire zones can be programmed in by the user.



Another picture of an M1114 HMMWV fitted with CROWS – it belongs to the 2nd Battalion, 8th Field Artillery Regiment. In this case CROWS is fitted with a 12.7mm M2 HB machine gun. It was with such a weapon that CROWS achieved a 70% hit rate during trials in 2002. In the test, 2,000 rounds were fired by a weapon zeroed at a distance of 300m. The target was 18x20 inches, and it was situated at a distance of 1,000m.

M1117 Guardian Armored Security Vehicle

The M1117 Guardian Armored Security Vehicle was one of the few vehicles in the U.S. Army inventory that was suited for counter-insurgency operations at the beginning of the conflict in Iraq. The 4x4 wheeled armored vehicle is based on the Cadillac Gage LAV-150. It was selected by the U.S. Army in 1995 as it met requirements for a new vehicle for the Military Police to replace the M1025/M1026 HMMWV Armament Carrier. After four prototypes were built in 1997, extensive testing was conducted. The U.S. Army Tank-Automotive and Armaments Command awarded an initial production contract (with a value of US$50 million) for ninety-four vehicles to Textron Marine & Land Systems in 1999. Final delivery of the vehicles under this contract took place in 2004.

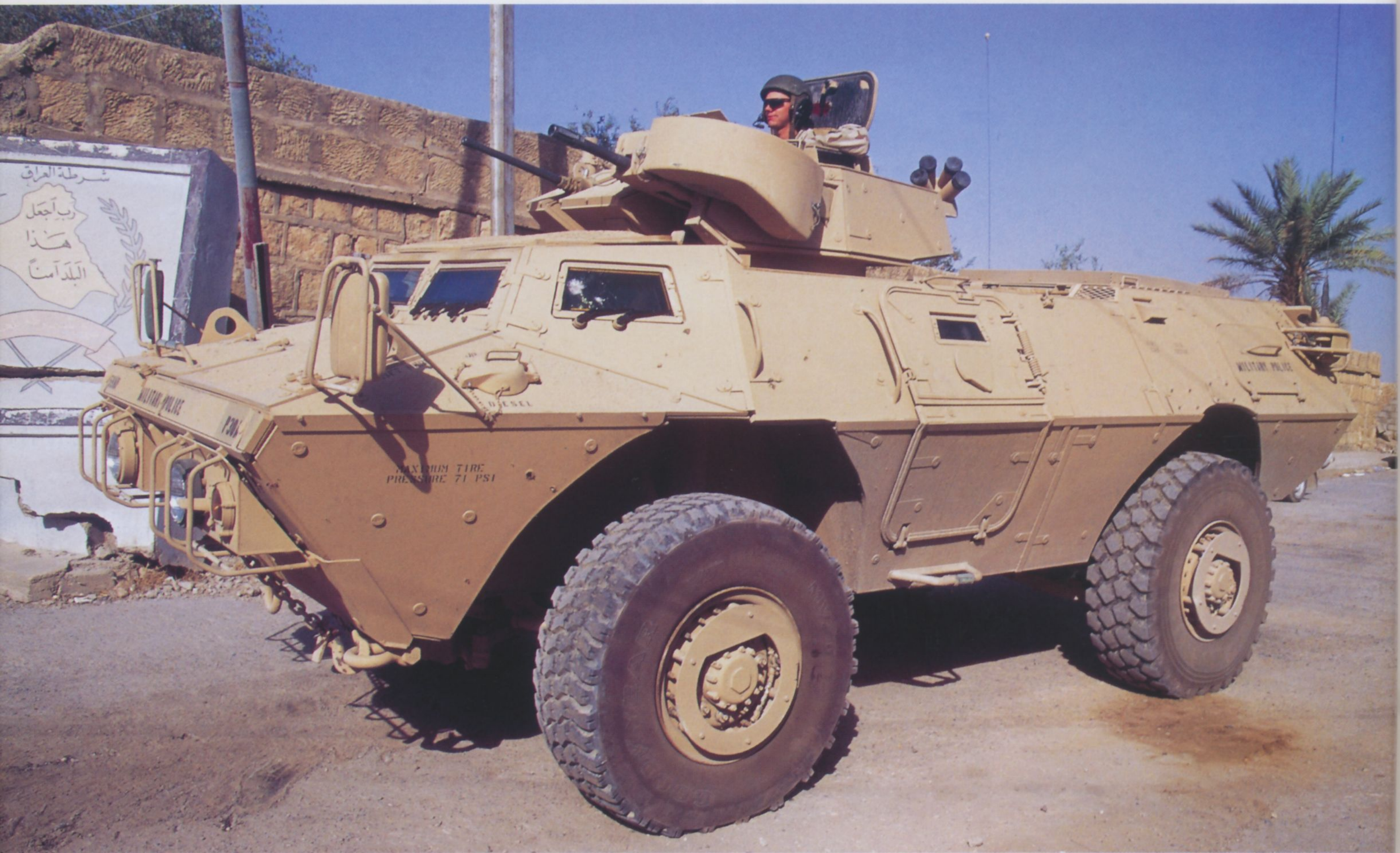
In August 2000 the first six production-series ASVs were issued to the 18th Military Police Brigade based in Germany. It was with this brigade that the Guardian saw its first operational deployment to Kosovo in 2001. As it did in Kosovo, the M1117 Guardian ASV made its combat appearance in Iraq with units of the 18th MP Brigade in the summer of 2003. A year later saw the U.S. Army placing additional orders for ASVs in 2004. One of these orders had a value of US$167 million, and it was for 212 vehicles to be delivered by April 2006. In July 2005 the U.S. Army ordered its latest and largest batch yet of M1117 Guardian ASVs. Under a US$258.8 million 'firm fixed price' contract, 724 vehicles were ordered. Production of these is due to be completed in June 2007. Once delivered, the inventory of the U.S. Army will consist of 1,118 vehicles. While initially only one ASV left the factory every three weeks, by late 2005 thirty-six vehicles were leaving the production plant every month.

Originally the M1117 Guardian ASV was designed for Military Police battlefield missions: area security, battlefield circulation control, enemy prisoner of war operations, and law and order operations. In Iraq the Guardian is used by the Military Police primarily for convoy escort missions and urban security operations. Other missions the vehicle has been regularly used for include reconnaissance and surveillance, quick reaction force tasks, cordon and search operations, and urban extractions.

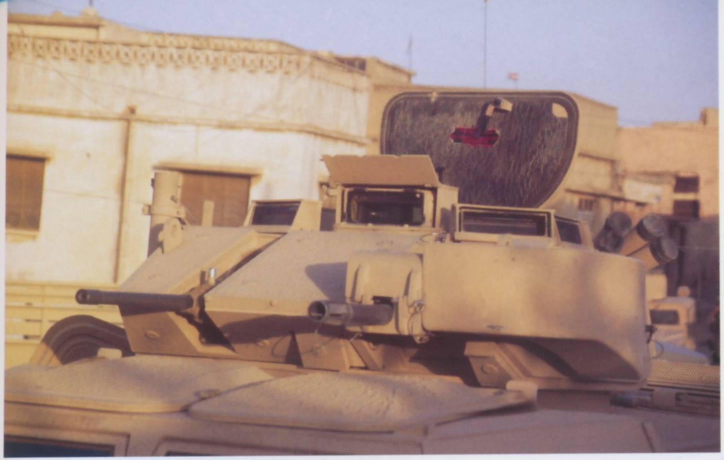
ASV technology

The hull of the M1117 Guardian ASV is made of all-welded steel armor. On the outside of the hull the Modular Expandable Armor System (MEXAS) is mounted. MEXAS consists of ceramic composite tiles mounted on a base layer. A spall liner fitted inside the vehicle provides additional protection for the crew. According to the ASV's manufacturer, the vehicle provides its crew with all-round protection against 12.7mm AP rounds and the fragments of a 155mm artillery shell detonated 15m overhead. The M1117 Guardian ASV is also able to withstand a 12lb mine blast under a wheel. Inside the hull the commander is seated in the front right and the driver in the front left. Both have ballistic windscreens in front of them, and a window made of the same armored glass to the side. A one-piece sliding hatch is provided above both their seats. On each side of the hull, an access door is situated through which the crew enters or leaves the vehicle's crew compartment. To the right of the vehicle a tunnel leads alongside the engine compartment to a two-part hydraulically operated rear access door.

The engine compartment is in the rear of the hull. In it is mounted the Cummins 6-cylinder 6CTA 8.3-liter diesel engine with exhaust turbocharger and inter-cooling. The engine allows the vehicle, with its combat weight of 13,408kg, to reach a top speed of 100km/h. Acceleration from 0 to 32km/h takes seven seconds. With the 189-liter capacity of its JP8 fuel tank, the ASV is able to cover a distance of 708km. Coupled to the engine is an Allison MD3560 automatic transmission with six forward and



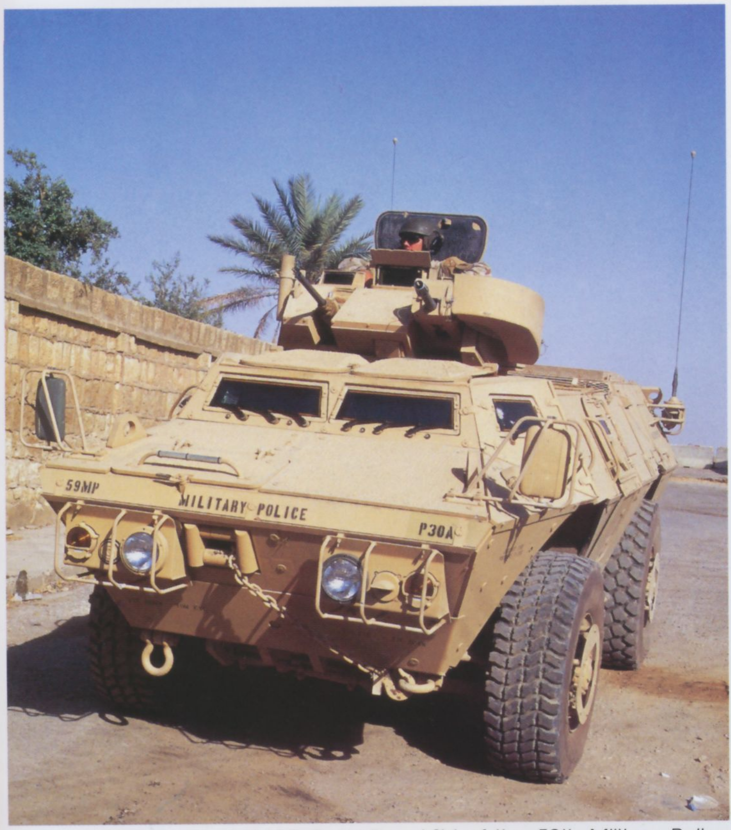
This M1117 Guardian ASV belongs to the 59th Military Police Company and was seen in Tall Afar in August 2005. The Guardian's armor, consisting of a welded steel hull, a spall liner, and MEXAS ceramic composite armor, provides the vehicle's crew with protection against 12.7mm AP rounds, 12lb mine blasts under a wheel, and 155mm artillery shell fragments.



Close-up of the electrically driven Cadillac Gage Up-gunned Weapon Station of the M1117 Guardian ASV. The UGWS is armed with a 12.7mm M48 Turret-Mounted Machine Gun and a 40mm Mk.19 Mod.3 Automatic Grenade Launcher. The ready ammunition for these weapons consists of ninety-six 40mm rounds and 200 12.7mm rounds.

one reverse gears. Outstanding cross-country mobility is ensured by the vehicle's fully independent suspension with coil springs. The Michelin 14.00 R20XZL tires feature a run-flat insert. Steering of the ASV is achieved by hydraulic power-assisted TRW Model TAS-65 steering. The brake system of the ASV is a completely independent high-pressure hydraulic system.

The armament of the ASV consists of a 12.7mm M48 Turret-Mounted Machine Gun and a 40mm Mk.19 Mod.3 automatic grenade launcher. Both weapons are installed in the roof-mounted electrically driven one-man turret, better known as the Cadillac Gage Up-gunned Weapon Station. The same UGWS is also mounted on the AAV7A1 Amphibious Assault Vehicle of the USMC. Ready ammunition for the weapons carried in the turret consists of ninety-six 40mm grenade rounds and 200 12.7mm rounds. The gunner is equipped with an M36E3 day-night sight with 1x and 7x magnification. Seven vision blocks provide a good 360° view. For night operations a strobe light can be mounted on the 12.7mm machine gun. A non-lethal grenade and smoke grenade launching system, consisting of two four-tube M257 LVOSS launchers, is mounted on the rear of the turret. In the turret the gunner is seated on a rail-mounted seat that can be adjusted in height. Above the seat is situated a one-piece hatch that opens to the top and rear. Other systems featured in the M1117 Guardian ASV are a Central Tire Inflation System, a powerful recovery winch with 6,795kg capacity, an NBC protection system, a fire detection and suppression system, an AN/PSN 11 Portable Lightweight GPS, two AN/VRC-91 radios, and an AN/VIC-3 Vehicular Intercommunication System.



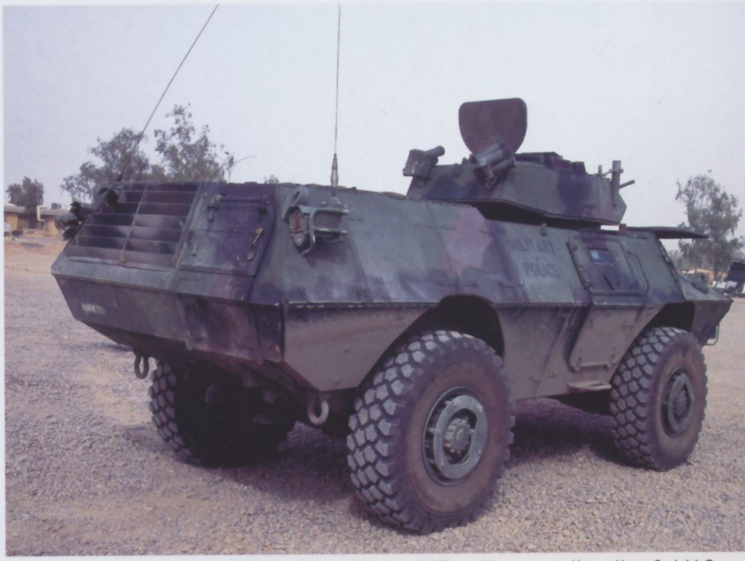
Another view of the M1117 Guardian ASV of the 59th Military Police Company. The Guardian is powered by a Cummins 6-cylinder 6CTA 8.3-liter diesel engine with exhaust turbocharger and inter-cooling. The 260hp engine allows the 13,408kg vehicle to reach a top road speed of 100km/h. Note the position of the recovery winch and the chain added to the cable ready for recovery operations.

Other M1117 Guardian users

According to recent rumors, the Iraqi government has signed a contract to purchase sixty-three M1117 Guardian ASVs. Of these fifty-seven will be in the Armored Security Vehicle variant, while four will be turret-less and used as command vehicles. The remaining two will be modified to act as a rescue-recovery vehicle. It is believed that the vehicles will be built with a different turret and feature internal security operations equipment, as the intent is to use them with government security units rather than to issue them to the Iraqi Army. The USMC borrowed some M1117 Guardian ASVs from the U.S. Army, and the U.S. Air Force owns two M1117 Guardian ASVs.

Tales from the battlefield

In an interview with a newspaper, Sgt. Marshall Dickinson of the 527th Military Police Company gave the following comments on the performance of the M1117 Guardian ASV in Iraq: "During RPG attacks, some of our ASVs were hit; they were damaged but the RPG warheads did not manage to penetrate the armor. Some RPGs were deflected by the angled armor. In one case an ASV returned forty-five kilometers to its base after an IED blew out all four tires. When we hit the IED it shook us a little but it was not as bad as it might have been in an up-armored HMMWV. We went everywhere with our ASVs that the HMMWVs went. While giving us a high degree of protection, like the much larger Bradley, the ASV has much smaller dimensions, a lower weight and a smaller turning radius. The ASV had no problem keeping up with truck convoys. It is a large vehicle but it has a smooth ride and we never encountered difficulties in traversing Iraqi villages." So far it looks like no soldier has been wounded or killed while operating under the protective armor of an M1117 Guardian ASV. One ASV was hit by an RPG from behind. The warhead took out the entire engine casing but the crew suffered no deaths or injuries.

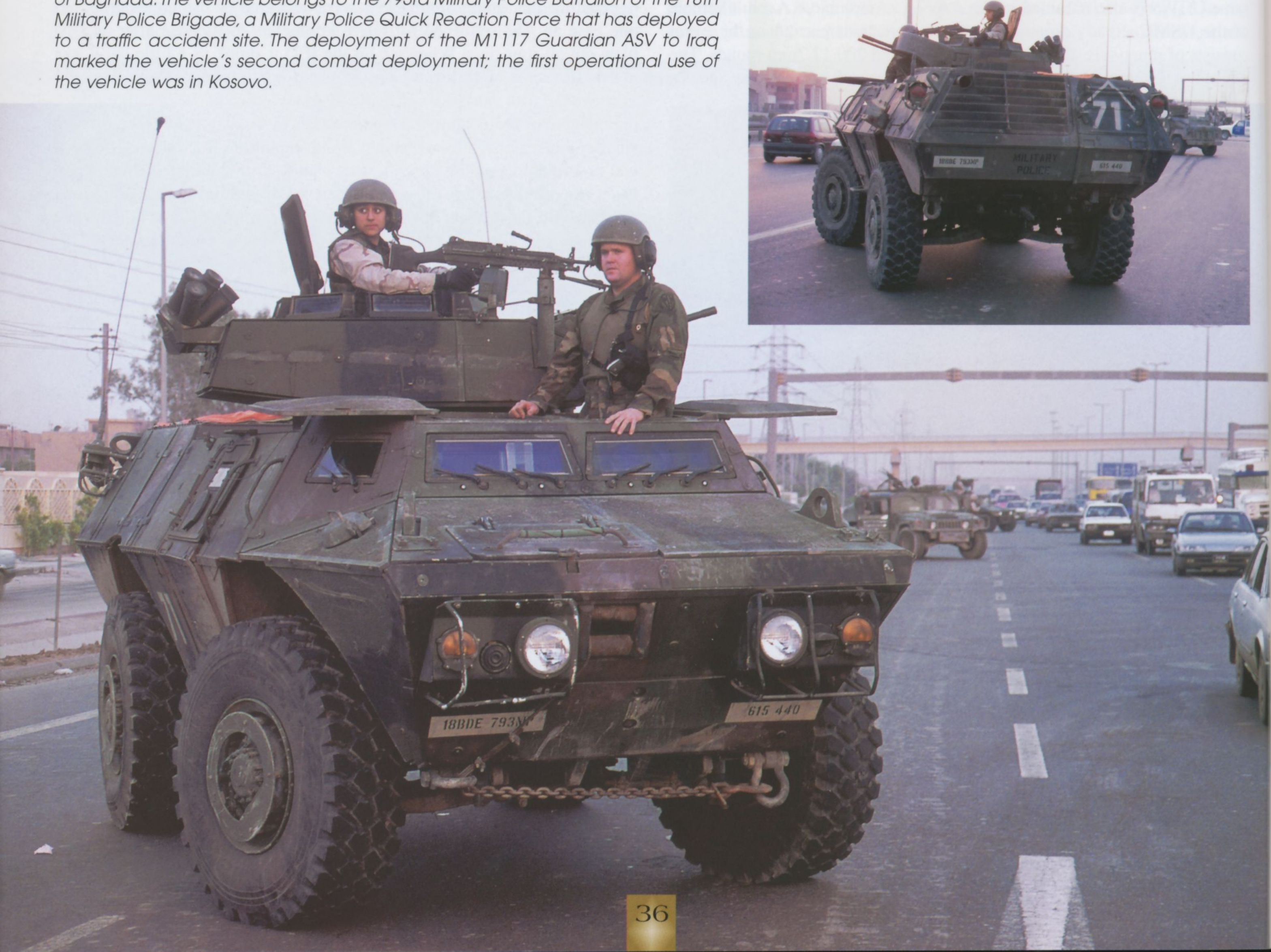


This M1117 Guardian ASV belongs to an MP unit supporting the 1st U.S. Cavalry Division in Baghdad in December 2004. The engine compartment of the Guardian is situated in the rear, with the door seen on the right side of the vehicle. A similar door also exists on the left. The crew enters and leaves the vehicle through these doors.

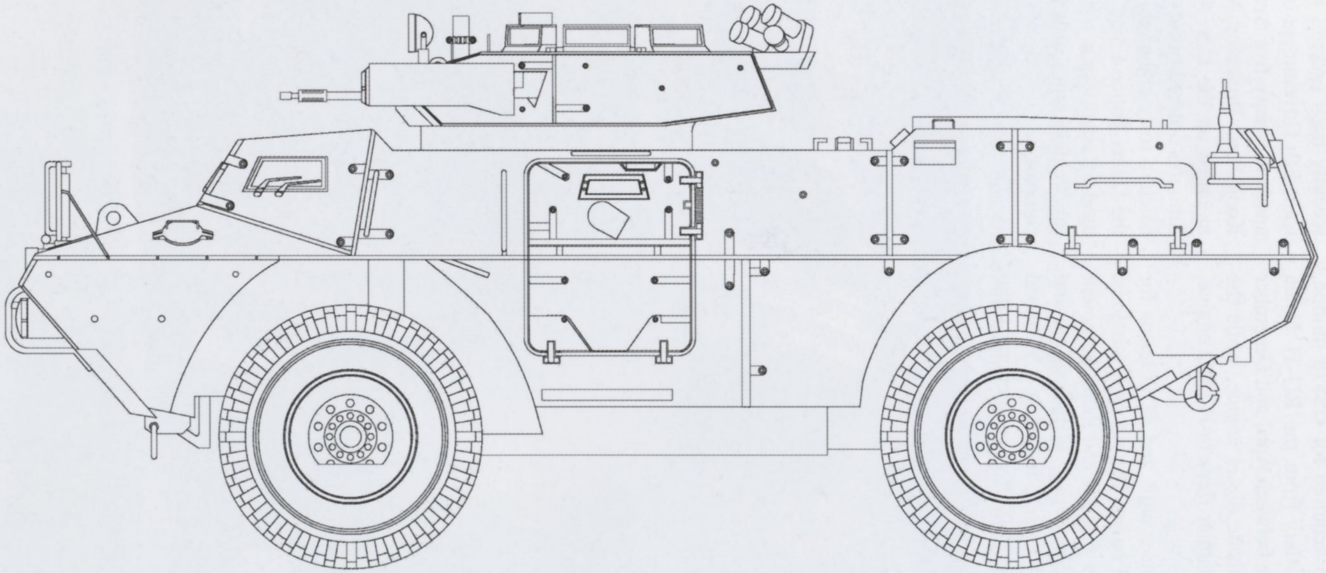
Technical Data for M1117 Guardian Armored Security Vehicle

Crew:	3 (driver, gunner and vehicle commander); an additional passenger can be carried
Combat weight:	13,408kg
Curb weight:	11,884kg
Length:	6.07m
Width:	2.56m
Height:	2.59m
Ground clearance:	460mm
Engine:	Cummins 6-cylinder 6CTA 8.3-liter diesel engine with exhaust turbocharger and inter-cooling
Performance:	260hp
Acceleration:	0 to 32km/h in 7 seconds
Maximum road speed:	100km/h
Turning diameter:	16.7m
Fording:	1.50m
Road range:	708km
Gradient:	60%
Side slope:	30%
Vertical obstacle crossing:	600mm
Fuel capacity:	189 liters
Transmission:	Allison MD3560 automatic transmission with six forward and one reverse gears
Armament:	1x 12.7mm M48 Turret-Mounted Machine Gun 1x 40mm Mk.19 Mod.3 Automatic Grenade Launcher
Armor protection:	All-welded steel armor, MEXAS ceramic composite appliqué armor, and spall liner providing protection against 12.7mm AP rounds, 12lb mine blast under a wheel, and 155mm artillery shell fragments
Air transportability:	1x in a C-130, 6x in a C-17
Manufacturer:	Textron Systems Marine & Land Operations, New Orleans, Louisiana

This M1117 Guardian ASV was seen on a motorway somewhere on the outskirts of Baghdad. The vehicle belongs to the 793rd Military Police Battalion of the 18th Military Police Brigade, a Military Police Quick Reaction Force that has deployed to a traffic accident site. The deployment of the M1117 Guardian ASV to Iraq marked the vehicle's second combat deployment; the first operational use of the vehicle was in Kosovo.



1/35 M1117 Guardian ASV

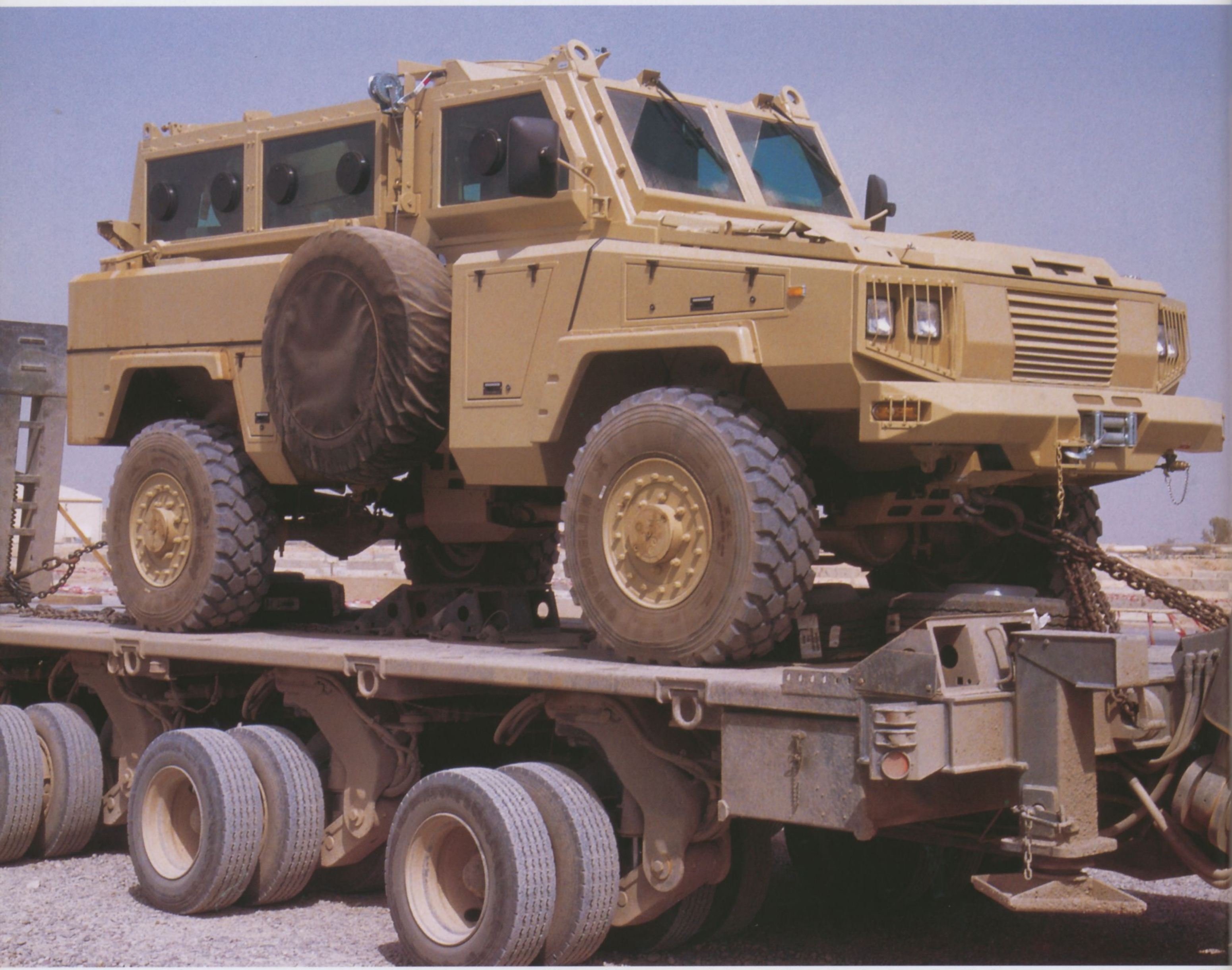


RG-31 Medium Mine Protected Vehicle

The RG-31 Medium Mine Protected Vehicle (MMPV) is based on the Mamba 4x4 wheeled APC. Also named the Nyala, the RG-31 MMPV was originally designed by OMC of South Africa, which is today part of BAE Land Systems. In the USA the RG-31 MMPV is marketed by General Dynamics Land Systems. The first three RG-31 vehicles were ordered by the U.S. Army for trials in 1996. In 2003 and 2004 the U.S. Army purchased a total of nine RG-31s to fulfill an urgent requirement for a mine-protected vehicle. These vehicles subsequently saw action in Afghanistan and Iraq. In February 2005 the U.S. Army ordered the RG-31 in larger quantities, and 148 vehicles were acquired for US$78 million. Called the RG-31 Charger, the vehicle differs from the RG-31 Nyala basically in its engine. Deliveries took place between April and December 2005. U.S. Army vehicles feature a U.S.-made diesel engine, while the Nyala is fitted with the option of either a Daimler-Benz or IVECO engine.

In Iraq the RG-31 is used mainly by engineer units and EOD teams for point, route and area clearance of IEDs and mines. During such missions, the primary role of the RG-31 is to provide soldiers and their equipment with a mobile protective platform for conducting identification and neutralization. The RG-31 MMPV is a 4x4 vehicle featuring a V-shaped all-steel, welded armor monocoque hull. The hull offers protection for the crew against small-arms fire and antitank mine detonations. The RG-31 offers protection against the effects of small-arms fire up to 5.56x45mm, with an optional protection level for weapons up to 7.62x51mm AP. The glass used in all the windows is bullet-resistant and tinted for optimum visibility and protection. The MMPV also has a specially designed hull that can withstand a double TM57-level mine explosion (14kg of TNT) under any wheel and a single detonation (7kg of TNT) centrally under the vehicle.

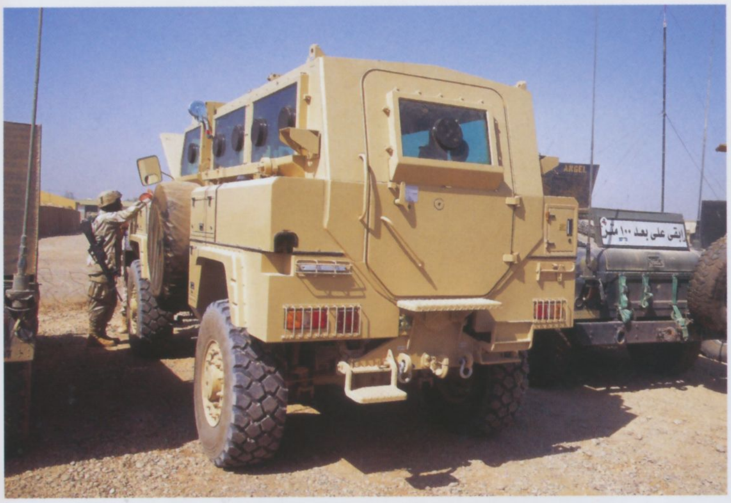
With the growing IED threat in a diverse range of places, the RG-31 has recently been ordered by several other nations. In November 2005 the Canadian Government ordered a batch of fifty RG-31s with an option for another twenty-five vehicles. These vehicles will be fitted with the Kongsberg Protector M151 Remote Weapon Station, which is also mounted on the U.S. Army Stryker IAV. In late 2005 the United Arab Emirates ordered twenty-eight RG-31 MMPVs with an option for a second batch of forty-eight vehicles. Back in 2002 some RG-31s were also sold to the Dubai Police Force. The RG-31 and its predecessor, the Mamba, are used by countless non-governmental organizations worldwide. In Iraq the two vehicle types also see service with several privately owned security companies.



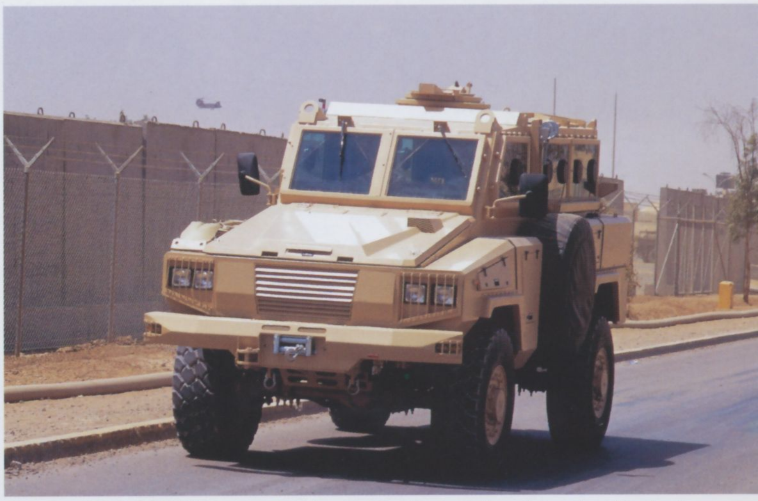
In February the U.S. Army ordered 148 RG-31 Chargers, and the vehicles were delivered from the factory directly to troops in Iraq. Here an RG-31 Charger can be seen loaded on a HETS. The vehicle has just arrived at FOB Warhorse in Baqubah and soon will be operated by A Company, 467th Engineer Battalion. The picture illustrates well the vehicle's high ground clearance, and a closer look reveals portions of the V-shaped hull.

Technical Data for the RG-31 MMPV

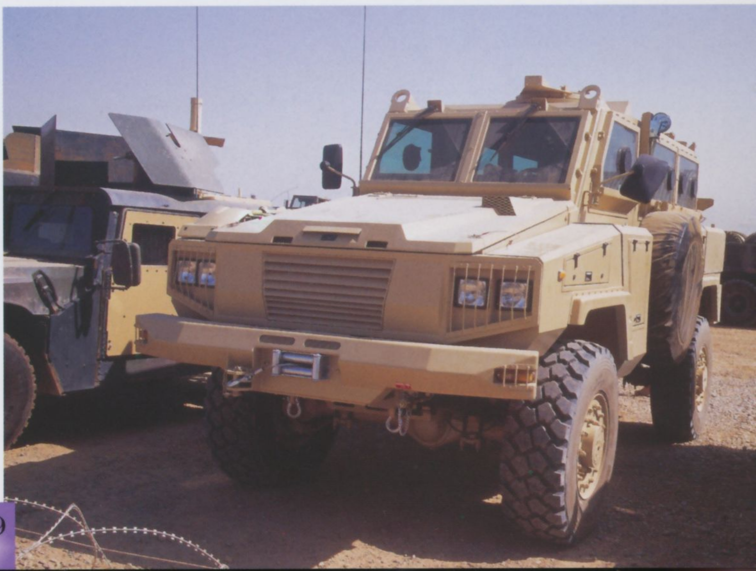
Crew:	1 (driver) + up to nine passengers
Combat weight:	8,400kg
Curb weight:	7,286kg
Length:	6.10m
Width:	2.25m
Height:	2.70m
Ground clearance:	353mm
Engine:	4-stroke, 6-cylinder, fuel-injected diesel engine
Drive train:	permanent 4x4
Acceleration:	0 to 60km/h in 30.5 seconds
Maximum road speed:	100km/h
Turning diameter:	13.5m
Road range:	600km
Gradient:	60%
Side slope:	35%
Steering:	Hydraulic power steering
Fuel capacity:	148 liters
Transmission:	4-speed automatic, 1 reverse gear
Armament:	ring mount that can be fitted with the option of a 12.7mm M2 HB or a 7.62mm M240B machine gun
Electrical system:	24 volt
Armor protection:	all-round protection against 5.56x45mm ammunition, and can withstand a double TM57-level mine explosion (14kg of TNT) under any wheel and a single detonation (7kg of TNT) centrally under the vehicle
Other systems:	Air-conditioning system
Air transportability:	1x in a C-130
Manufacturer:	BAE Land Systems OMC South Africa, and General Dynamics Land Systems



The crew of the RG-31 Charger enters the vehicle through a large rear door. The window of the door is made of bulletproof glass. Mounted in the center of the window is a firing port that allows the crew to use their small arms if required. The V-shaped design of the vehicle, the appearance of which is obstructed by externally mounted storage boxes, can still be discerned. The V-shape deflects the blast of mines and IEDs, and is therefore an important part of the protection concept of the vehicle.



The RG-31 MMPV is powered by a 6-cylinder diesel engine that allows the 8,400kg vehicle to accelerate from 0 to 60km/h in 30.5 seconds. Maximum road speed of the RG-31 Charger is 100km/h. Note the hatch and ring mount on the roof - the vehicle can be fitted with a 12.7mm M2 HB machine gun or a 7.62mm M240B machine gun.



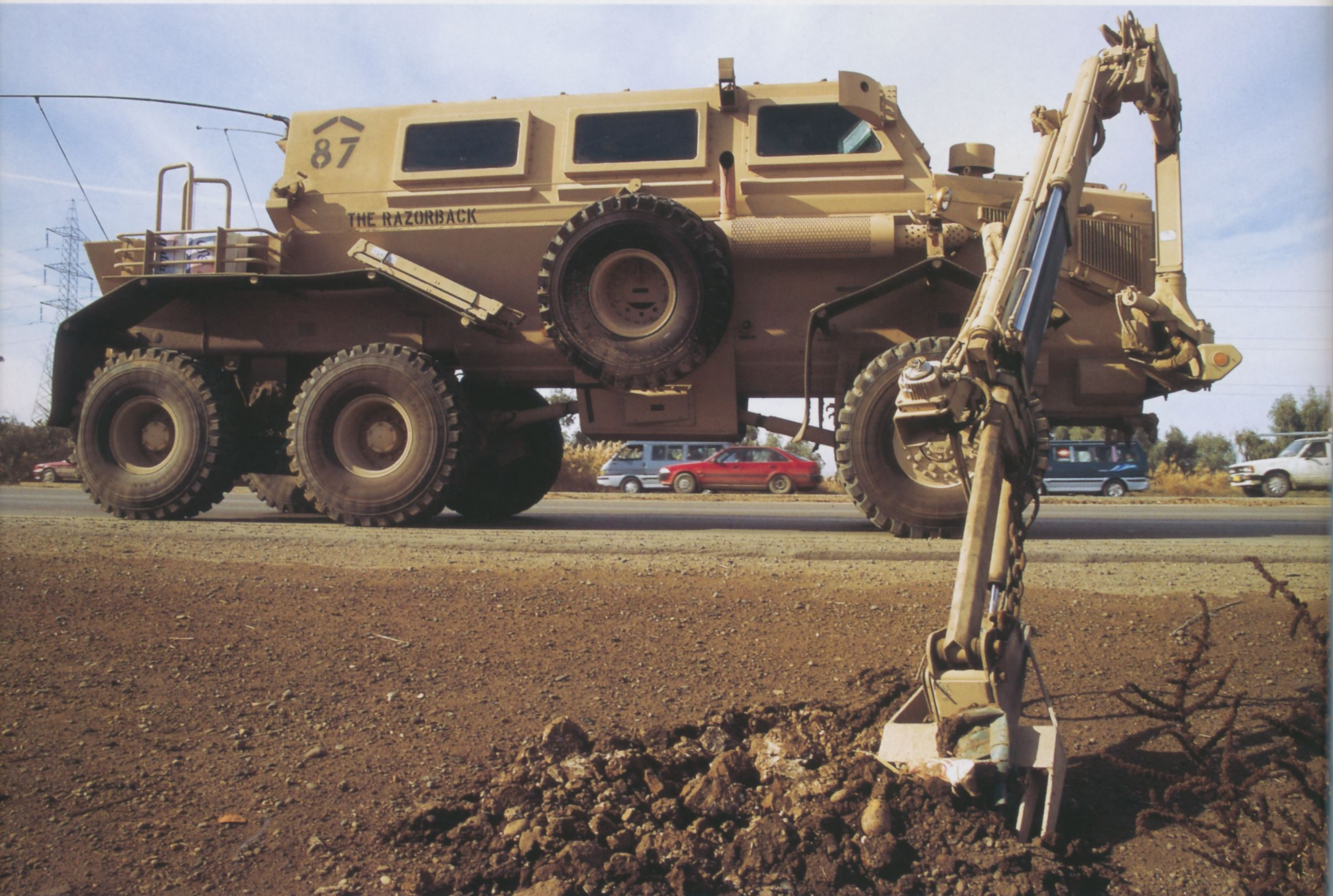
The V-shaped hull and suspension of the RG-31 can withstand a double TM57-level mine explosion (14kg of TNT) under any wheel and a single detonation (7kg of TNT) centrally under the vehicle. The hull and bulletproof windows also protect the crew from small-arms fire. Here a near brand new RG-31 of A Company, 467th Engineer Battalion, can be seen at FOB Warhorse in Baqubah in August 2005.

Buffalo Mine Protected Clearance Vehicle

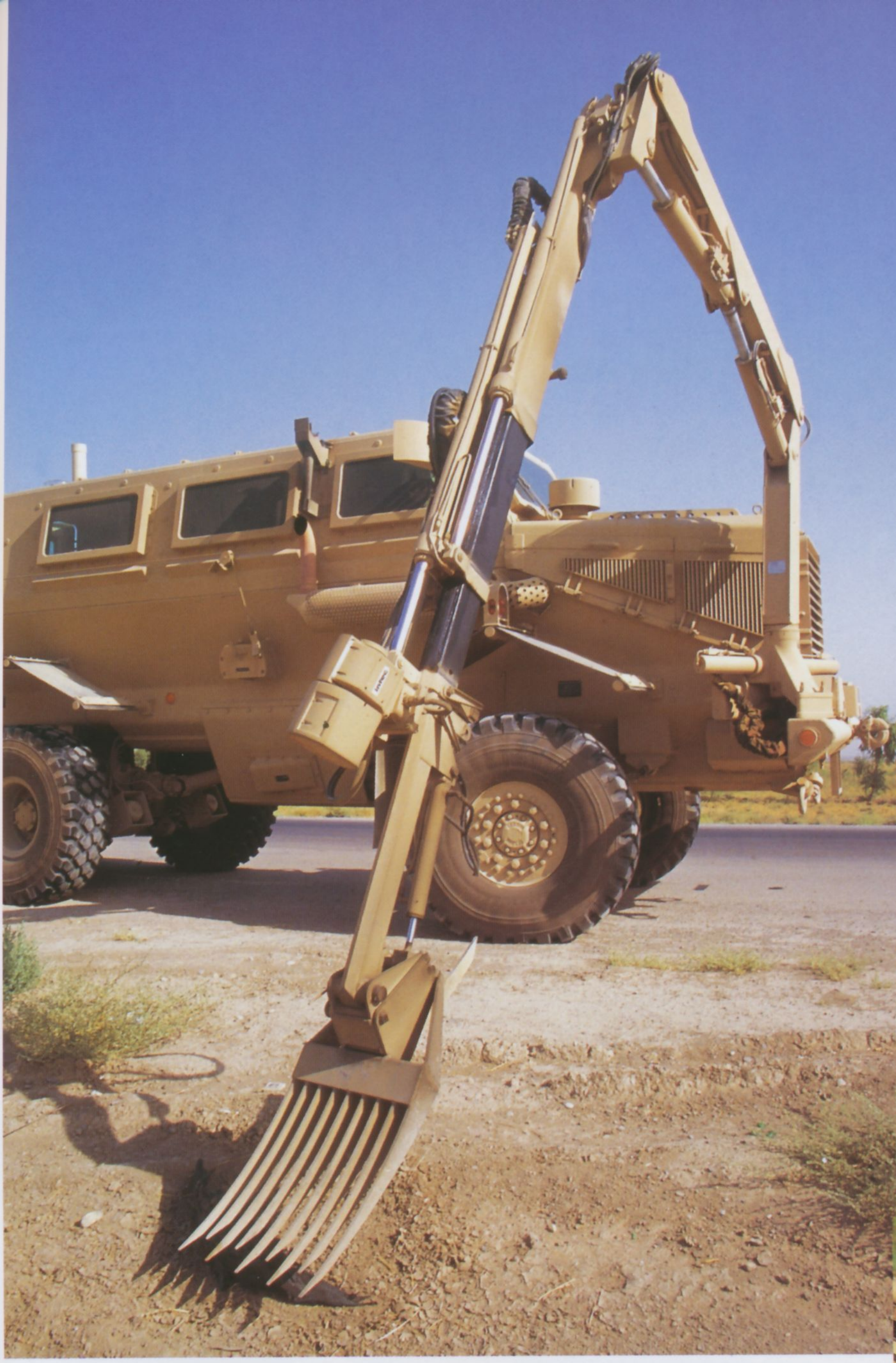
As early as 2001 the U.S. Army began its search for a vehicle that would provide additional capabilities to its Ground Standoff Minefield Detection System - the Meerkat MDV and Husky T/MDV. The GSTAMIDS provides forces with a mine and IED detection and marking capability in support of route clearance operations during stability and support operations. The new vehicle was required to examine suspicious objects from the safety of an armored hull. After trials of existing vehicles already on the market, Force Protection Incorporated received a first order for ten vehicles in July 2002. These vehicles were delivered in 2003 and were immediately deployed to Afghanistan and Iraq. Additional orders followed in 2004, with twenty-one vehicles ordered in May and fifteen Buffalo MP/CVs in November. In September 2005 the USMC bought four Buffalo MP/CVs. In early 2006 another order placed by the U.S. Army Tank Automotive and Armaments Command for nineteen vehicles was received by Force Protection Incorporated.

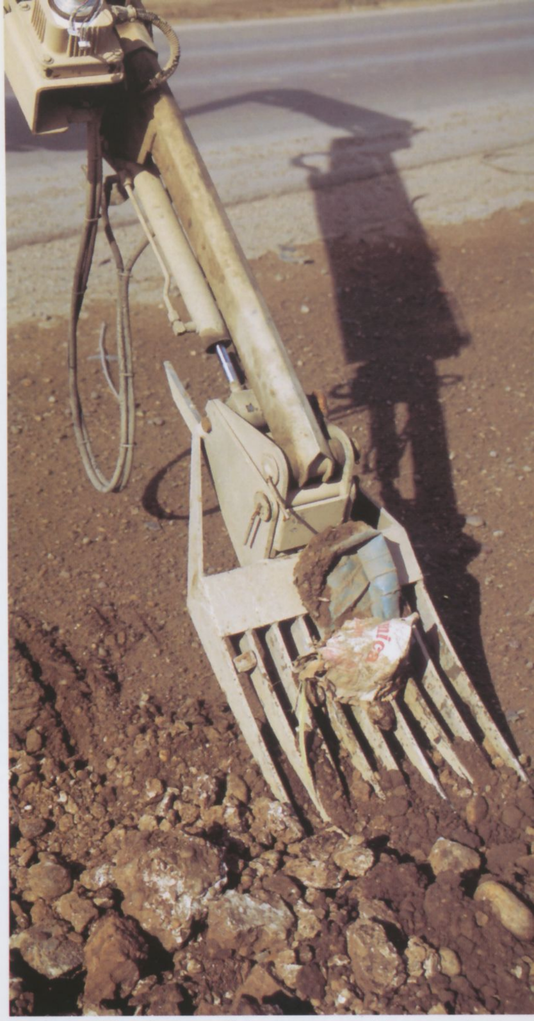
The Buffalo is based on a V-shaped hull that can withstand mine blasts or IED detonations much better than conventionally armored vehicles. In addition, the hull offers all-round protection from 7.62x51mm NATO standard ball ammunition and 155mm artillery shell splinters. The same level of protection is provided by the vehicle's windows, which are made of bulletproof glass. The V-shaped hull results in a high vehicle silhouette, which, along with the heavy-duty suspension, benefits the vehicle's cross-country capabilities. At the front of the 37,800kg vehicle the Mack ASET AI-400 diesel engine is situated. The engine develops 450hp and allows the Buffalo MP/CV to reach a top speed of 105km/h. The engine is connected to an Allison HD-4560P 5-speed automatic transmission from which the power is transferred to the axles via drive shafts. The front axle of the Buffalo MP/CV is a Fabco SDA 2300 23,000lb drive steering axle, while the rear axle is a Mack tandem 50,000lb axle. The vehicle's fuel tank can hold 385 liters of diesel fuel, enabling the Buffalo MP/CV to cover up to 615km.

In the crew compartment the driver sits at the front left while the vehicle commander sits to his right. Situated in front of the commander's seat is the remote control panel for the 4.9m long hydraulically operated steel arm. The panel features a TV screen on which the picture, captured by the camera mounted on the end of the arm, is broadcast. At the end of the arm a fork and a ripper are mounted. This tool can be used to examine objects, and even dig them out if necessary. Additional seats are situated in the rear for extra personnel. Every seat is equipped with a four-point seatbelt harness. The Buffalo is equipped with a Red Dot air-conditioning system that makes operating even in very hot climates that little bit more bearable. The roof of the crew compartment features six hatches. The Buffalo MP/CV is prepared so that it can be fitted with a ring mount for machine guns. However, no vehicle has so far been seen fitted with it. The only way to enter or leave the troop compartment is via the rear door. Access to this door is achieved by using a ladder mounted on the rear of the Buffalo MP/CV. A spare wheel is mounted on the left between the front and the double rear axle. Due to its modular design, the Buffalo MP/CV can be repaired in the field if it is damaged by a mine blast or an IED.



The Buffalo MP/CV allows troops, from the safety of an armored hull, to examine suspicious objects that could potentially be IEDs. This is done by operating a remote-controlled hydraulic arm and camera in order to screen potential explosive threats. Troops can then set them safely to one side, or if necessary, disarm or discharge them. This Buffalo MP/CV belongs to the 239th Engineer Company and is nicknamed "The Razorback". It was seen on MSR Tampa in December 2004.

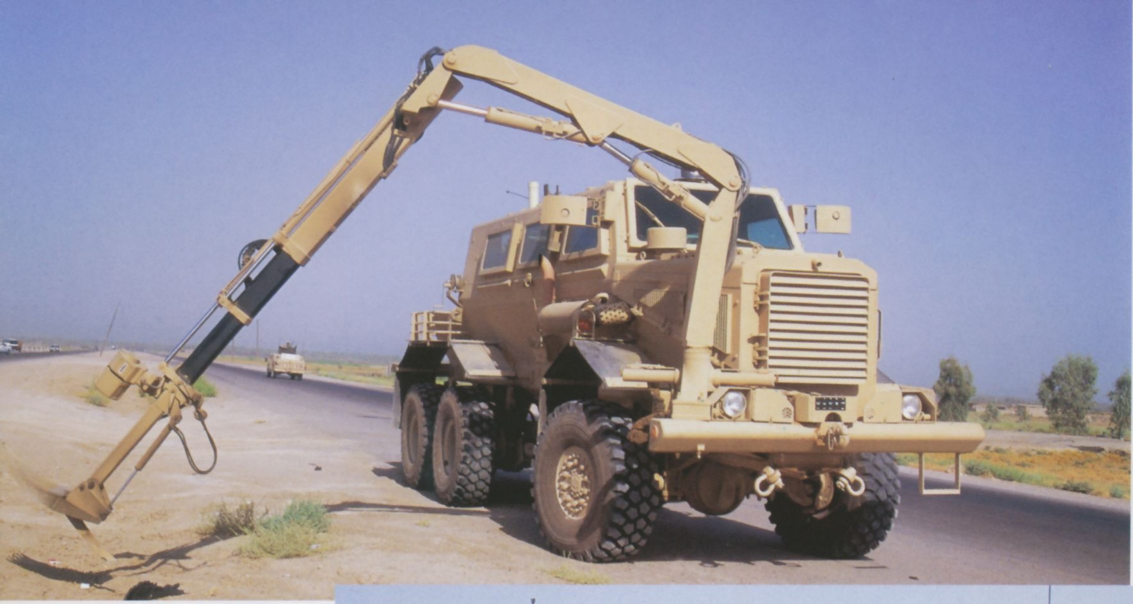




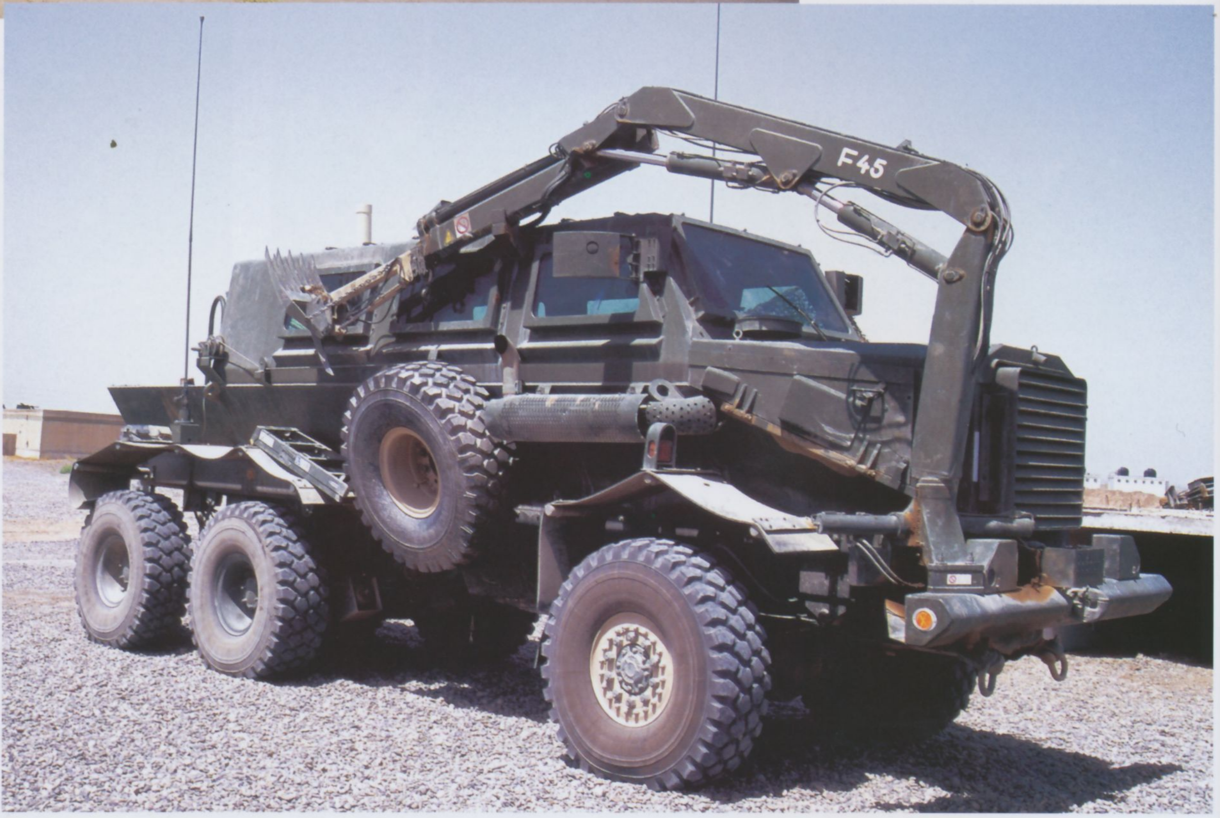
Detail of the fork and ripper assembly mounted on the end of the remote-controlled hydraulic arm of a Buffalo MP/CV. In view is the camera mounted above the hydraulic arm, which is used to screen any explosive threat, as well as to provide the controller of the arm with a close-up view of the working area.

Technical Data for Buffalo MP/CV

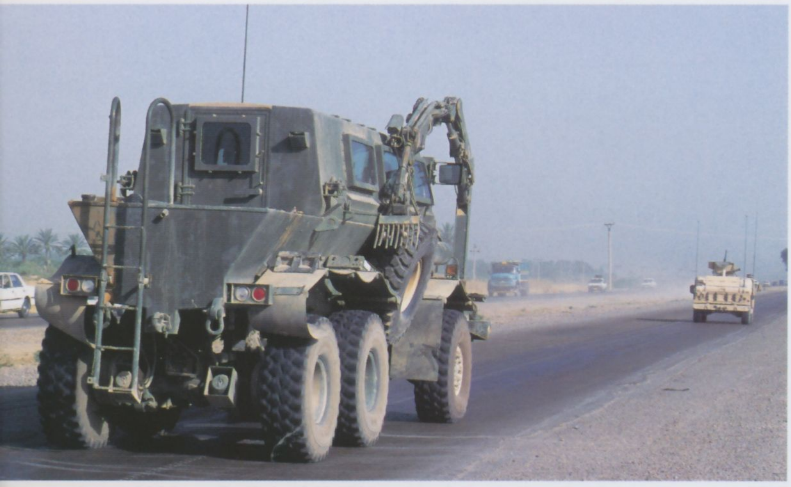
Crew:	1+13 (driver, vehicle commander and up to 12 passengers)
Combat weight:	37,800kg
Curb weight:	20,394kg
Length:	8.204m
Width:	2.464m
Height:	2.972m
Ground clearance:	406mm
Engine:	Mack ASET AI-400 diesel
Performance:	450hp
Maximum road speed:	105km/h
Fording:	1.016m
Road range:	615km
Approach angle:	40°
Departure angle:	45°
Fuel capacity:	385 liters
Transmission:	Allison HD-4560P 5-speed automatic
Armor protection:	all-round against 7.62x51mm NATO standard ball, 155mm artillery shell splinters; protected against mine blasts under wheels and centerline of vehicle.
Tires:	Michelin 1600 R20XL
Manufacturer:	Force Protection Incorporated, South Carolina



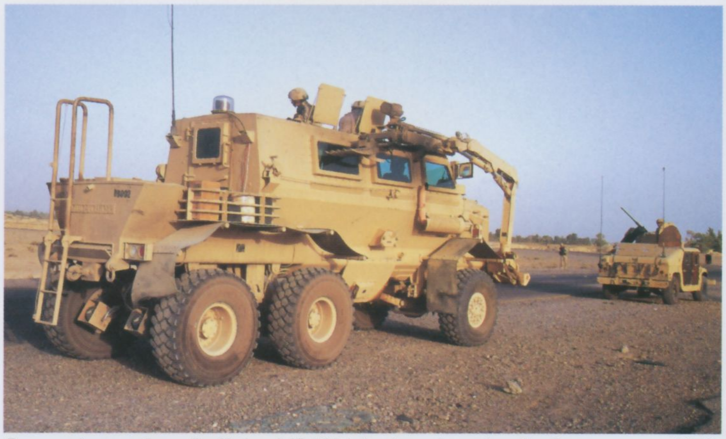
August 2005, somewhere northeast of Baqubah, a Buffalo MP/CV is using its hydraulic arm to investigate a suspicious object found on the roadside along an Alternative Supply Route. The vehicle belongs to A Company, 467th Engineer Battalion, and is being used in conjunction with four HMMWVs to conduct IED sweeps. The Buffalo MP/CV has a combat weight of 37,800kg, is 8.204m long, 2.464m wide and 2.972m high.



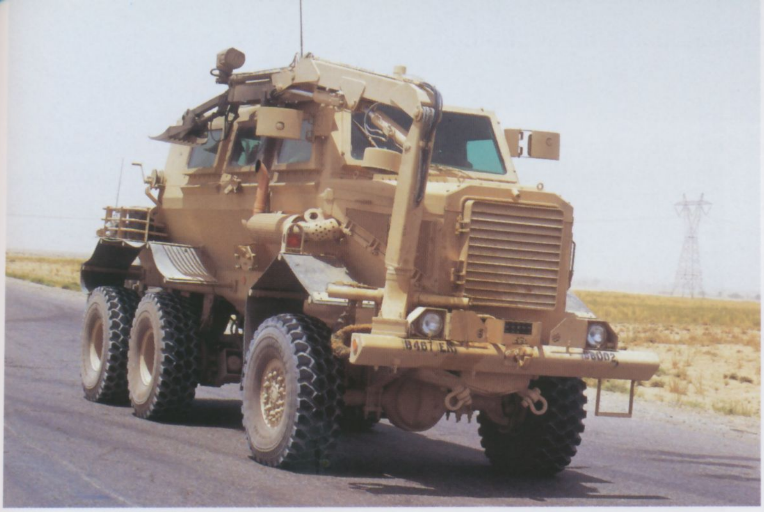
This Buffalo MP/CV was seen at FOB O'Ryan south of Balad in June 2004. The vehicle belongs to the 489th Engineer Battalion. The Buffalo's suspension is made of semi-elliptic leaf springs that, when combined with the vehicle's ground clearance of 406mm, provides an outstanding cross-country capability.



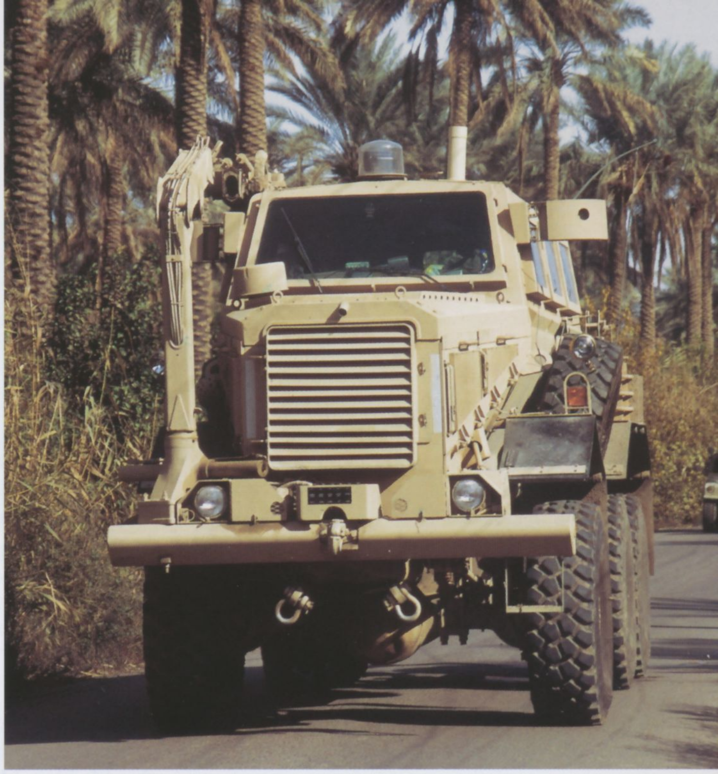
June 2004, a Buffalo MP/CV operates in the Balad region on MSR Tampa. Observe the vehicle's rear door, which is the only means of access to the armor-protected hull of the vehicle. Note that the vehicle is painted in a dark green color, while most Buffalo MP/CVs seen in Iraq are painted in a desert camouflage color.



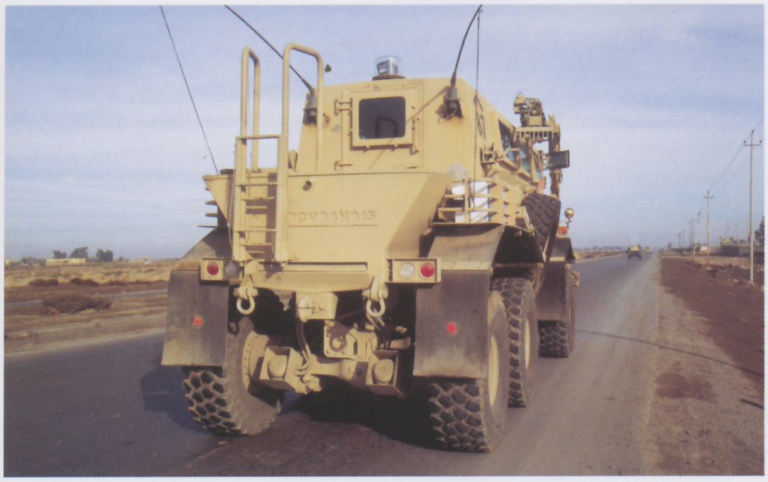
Rear view of a Buffalo MP/CV belonging to A Company, 467th Engineer Battalion. Due to the battalion's mission of keeping roads in northern Iraq free of IEDs, the unit is also called Task Force Trailblazer. Note the open hatches of the Buffalo MP/CV, with a total of six situated in the roof. Also visible is the rear door that is the only access to the large crew compartment that offers space for up to fourteen troops.



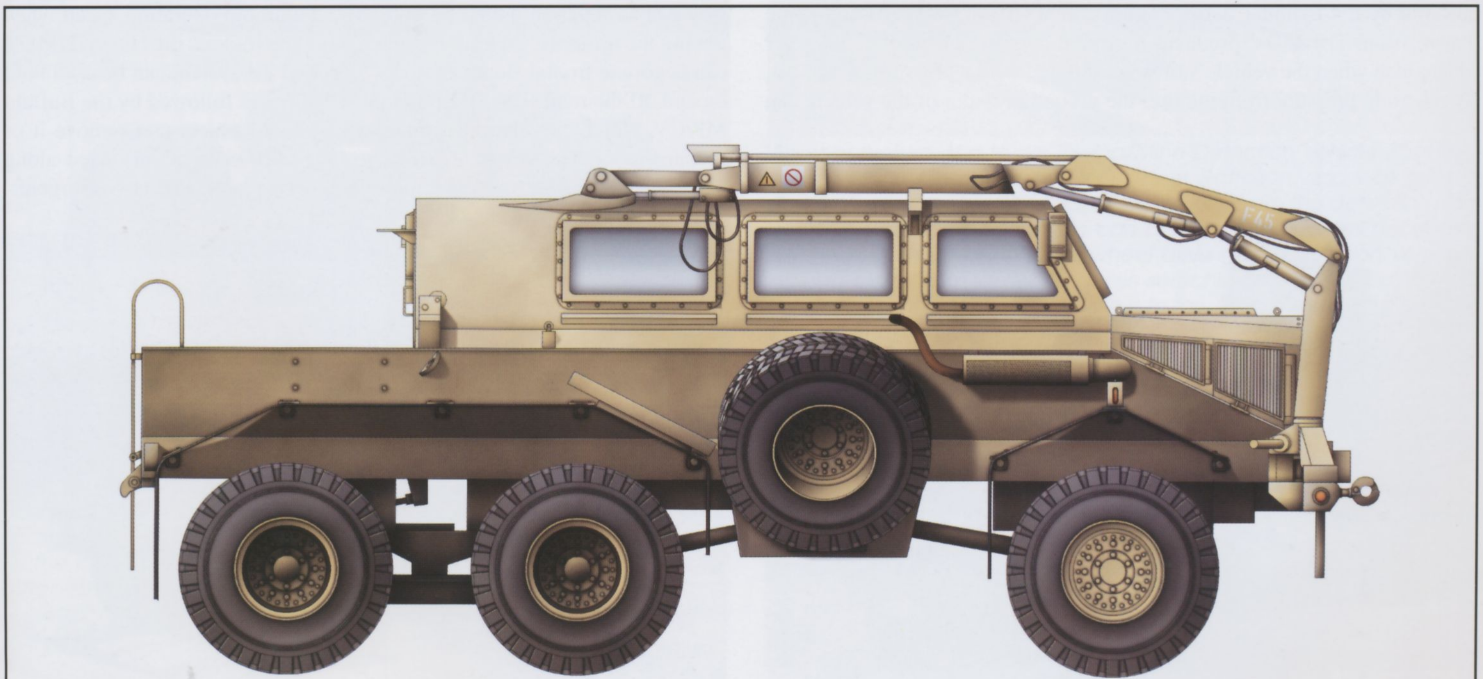
This Buffalo MP/CV belongs to the 467th Engineer Battalion and was seen near Bayji in July 2005. The Buffalo MP/CV is powered by a Mack ASET AI-400 diesel engine that develops 450hp. The engine is connected to an Allison HD-4560P 5-speed automatic transmission. The 37,800kg vehicle can reach a top speed of 105kmh on roads.



The Buffalo MP/CV is used by U.S. Army units in Iraq for road clearance. With an escort of armed HMMWVs, Buffalo MP/CVs travel along convoy and patrol routes as their crews search for suspicious objects along roadsides. Once a suspicious item is found, the area is sealed off and the Buffalo investigates it. This Buffalo is being used by the 239th Engineer Company of the Arkansas Army National Guard in December 2004.



Rear view of a Buffalo MP/VC operated by the 239th Engineer Company of the Arkansas Army National Guard. The front axle of the Buffalo MP/CV is made by Fabco, while the rear axle is a Mack tandem 50,000lb type. Apparent is the V-shape of the vehicle hull, which deflects the blast away from the hull in the case of a mine explosio.



Buffalo MP/CV, 239th Engineer Company, near Balad, December 2004

The Buffalo Mine Protected Clearance Vehicle allows U.S. troops to examine suspicious objects such as IEDs or mines, all the while being protected by the heavily armored hull of the vehicle. The Buffalo is based on a V-shaped hull that can withstand detonations of mines or IEDs. In addition, the hull offers all-round protection from 7.62mm x 51 NATO standard ball rounds, and 155mm artillery shell splinters. The vehicle is fitted with a remote-controlled hydraulic arm and camera to screen suspicious objects. With the fork and ripper assembly mounted on the end of the arm, objects can be lifted, moved or excavated.

Meerkat MDV and Husky T/MDV

The Ground Standoff Mine Detection System is a vehicle-mounted mine detection system used for the detection of buried and surface-laid metallic and low-metallic antitank mines. Designed by Rolling Stock Solutions of Johannesburg, South Africa, the system entered service with the U.S. Army in 1998. Originally called the Interim Vehicular Mounted Mine Detection (IVMMD) system, the name changed into GSTAMIDS, and the system has been upgraded from time to time and modified to meet the latest threats. The system saw its first operational service with U.S. troops in Afghanistan in 2002. The U.S. Army plans to buy a total of 170 GSTAMIDS.

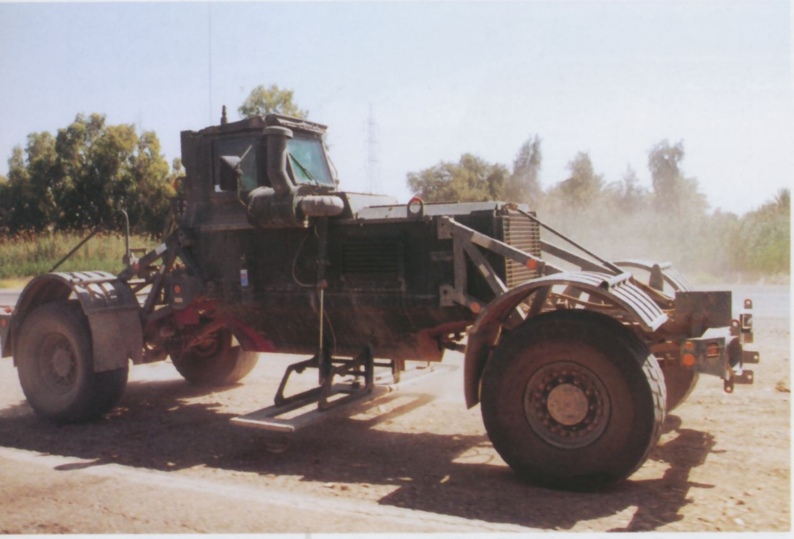
Although under constant development, the current basic configuration of the GSTAMIDS consists of a Meerkat Mine Detection Vehicle, a Husky Towing/Mine Detection Vehicle, the First Mine Detonation Trailer, the Second Mine Detonation Trailer, and the Third Mine Detonation Trailer. In addition, a Buffalo MP/CV is used as a command vehicle to investigate suspicious objects. Also essential for operating the GSTAMIDS is a 10-ton truck carrying the Spare Wheel Modules and Tools for the MDV and T/MDV, called "Red pack". A second set of spares and tools for maintenance work, the "Blue pack", also belongs to the GSTMIDS.

In Iraq parts of the system can often be seen operating on their own. However, the usual way of operating the GSTMIDS is as follows. The leading element of the system during operations is the Meerkat MDV vehicle, whose only mission is to detect mines or IEDs. The Meerkat MDV is fitted with two mine detection induction coils in a three-meter wide operational array, and it uses mine detection and ground penetration radar sensors. When in the "locate mode", mine detection on roads and tracks is possible up to a maximum speed of 35km/h. When a metallic object is detected the operator is warned by both an acoustic and optical signal. The vehicle is then brought back over the object that has been found, and the "pinpoint mode" is used to find the center of the object. When the suspicious object is located, the marking system of the Meerkat MDV is used; this is a nozzle mounted on the rear frame and centered on each detection array, and it marks the ground with ink.

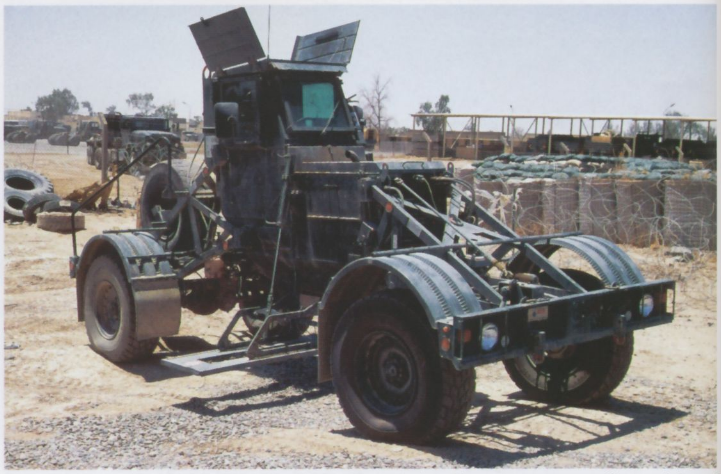
The Meerkat MDV has a weight of 4.8 tons, is rear-wheel driven, and is powered by a 4-cylinder diesel engine connected to a 5-speed automatic transmission. The MDV produces a ground pressure of only 12.56kg per square inch when the vehicle's tires are inflated with a pressure of 14.5psi. By releasing pressure from the tire, the ground pressure of the vehicle can be further dropped, which makes the detonation of a mine most unlikely. However, an antitank mine may still be detonated if the fuse sensitivity of a pressure-fused mine is very low. The Meerkat is designed to withstand such a blast and offers the operator the highest possible level of protection. The V-shaped underbody directs the blast away from the vehicle, and is designed to withstand the blast of an antitank mine, or 6.75kg of TNT. The body of the Meerkat MDV is constructed of heavy-gauge armor plates and it also protects its operator from the effects of small-arms ammunition up to a caliber of 7.62x51mm, even when AP rounds are used. If the Meerkat MDV is damaged during a mine blast, the vehicle can be rapidly repaired in the field using the Spare Wheel Modules and the Center/Frame/Jack/Tool sections of the "Red pack". The vehicle features front and rear wheel modules constructed in an open framework design, which are attached to the vehicle body.

Following in the path of the Meerkat MDV is the Husky T/MDV. This vehicle has the same detection capabilities and operational advantages as the Meerkat MDV, but it is more powerful and pulls the three Mine Detonation Trailers. It acts as an alternative detection vehicle. The Husky T/MDV is powered by a 6-cylinder turbocharged diesel engine connected to a 6-speed manual synchromesh transmission. It is a 4x4 vehicle, and it weighs 9 tons and has a ground pressure of 22.41kg per square inch. The armor-protected hull of the vehicle is made of heavy-gauge armor plates and features additional ceramic armor for the driver's compartment. The protection level of the armor is similar to that of the Meerkat MDV. When the full system is operated, the Husky T/MDV tows a set of three Mine Detection Trailers (MDTs). The trailers each have two axles of different lengths, and they are very heavy. They are designed to apply maximum ground pressure and to clear a path that is 3m wide. Their mission is to detonate with their wheels any mine that has not been detected by the Meerkat MDV and Husky T/MDV. This, for example, might be a non-metallic mine made of wood or plastic.

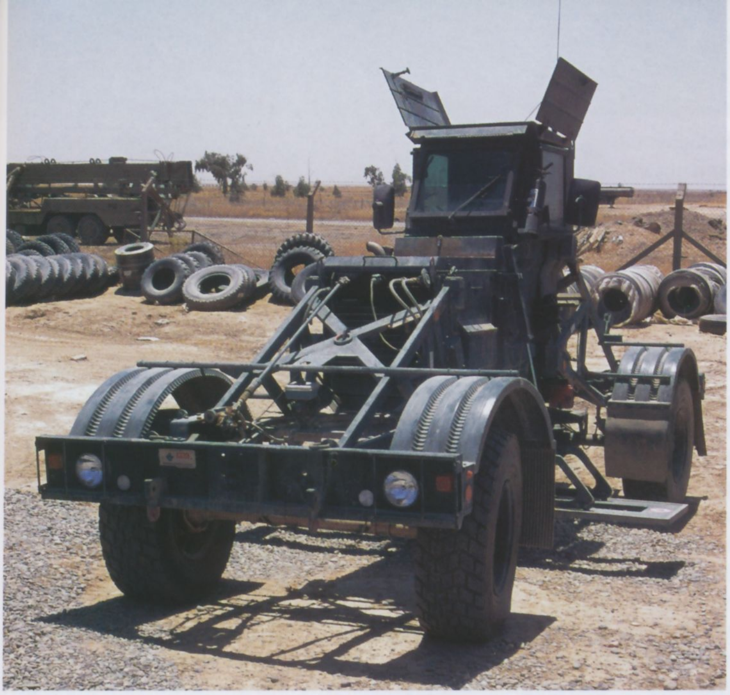
Like the MDV and the T/MDV, the MDTs are of rugged design and when a wheel detonates a mine, the wheel bolts are designed to shear so that repair work is limited to replacing a single wheel. Trailers damaged in this way can be repaired within an hour. The maximum operating speed when towing the trailers is 20 km/h. While towing the trailers, the Husky T/MDV can negotiate frontal slopes of up to 20%, and the system can be used both on and off the road. The MDV and the T/MDV are followed by the Buffalo MP/CV, which can also investigate a suspicious object and remove it or prepare it for detonation. In Iraq the GSTAMIDS is mainly used along convoy roads in order to detect mines and IEDs placed there by insurgents.



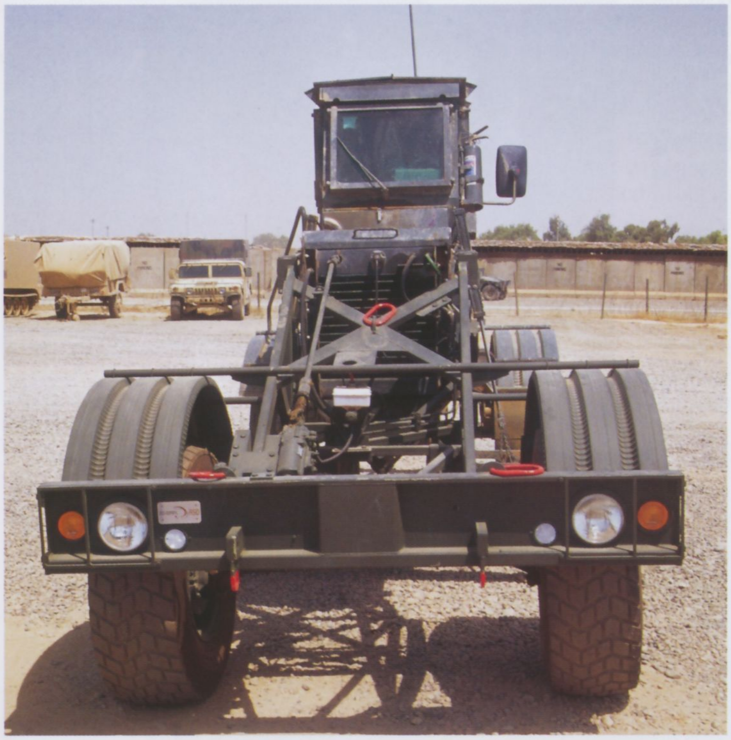
This Husky T/MDV belongs to the 489th Engineer Battalion and was seen during an IED sweep on MSR Tampa in June 2004. With the Husky it is possible to detect mines and IEDs hidden under the surface using an operational speed of up to 35km/h. The vehicle is usually used to tow the three Mine Detonation Trailers of the IVMMD. Along with the Meerkat MDV and the Buffalo MPCV, the vehicle forms the Interim Vehicle Mounted Mine Detector System. (Picture courtesy of Ralph Zwilling)



The Meerkat MDV is fitted with mine detection pans on either side of the hull that can be raised and lowered pneumatically. Like the Husky T/MDV, the vehicle is able to detect mines and IEDs within a 3m path up to an operational speed of 35km/h. The Meerkat MDV is generally the leading vehicle, followed by a Husky T/MDV. This vehicle belongs to the 489th Engineer Battalion, and was seen at FOB Speicher near Tikrit in June 2004.

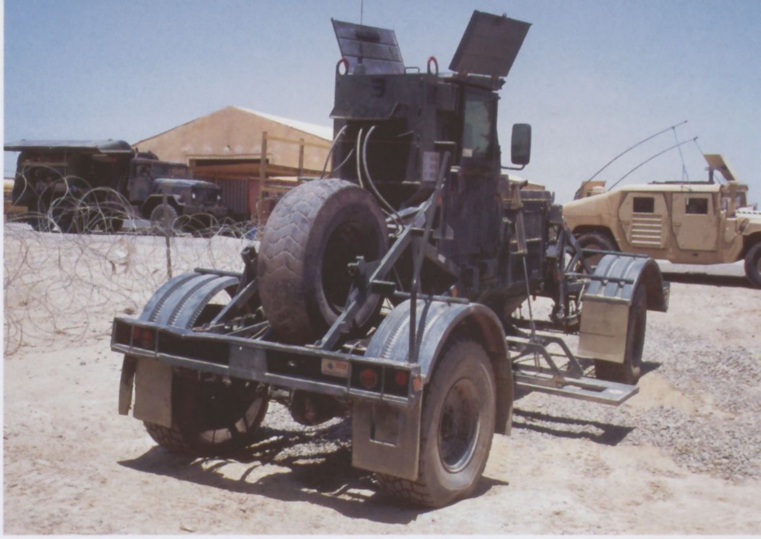


Another picture of the same Meerkat MDV. The body of the Meerkat MDV is constructed of heavy-gauge armor plates and it protects its driver from the effects of mine blasts, IED splinters, and small-arms ammunition up to a caliber of 7.62x51mm, even when AP rounds are used. Powering the vehicle's rear axle is a 4-cylinder turbocharged diesel engine. The vehicle has a very low ground pressure that allows it to pass over pressure fuses of antitank mines while not exerting sufficient ground pressure to set them off.

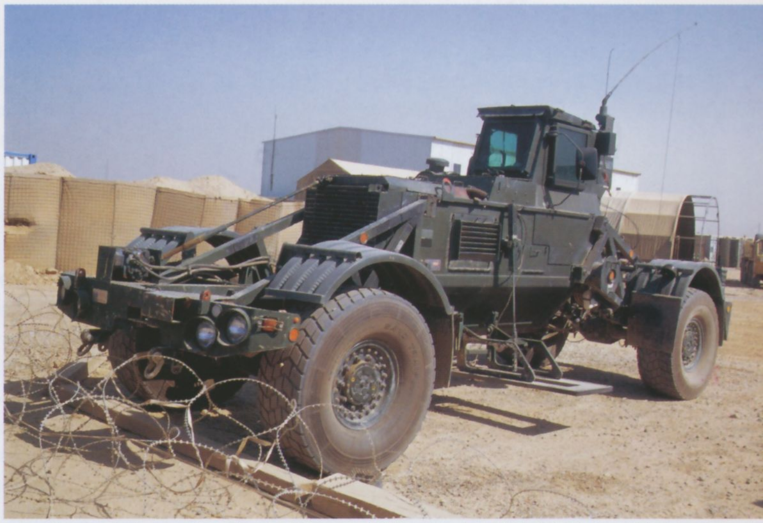


The front and rear wheel modules of the Husky T/MDV are constructed in an open framework design and are attached to the vehicle body. In the case of a mine detonation, they can break away and do not offer resistance to the blast force. The whole Husky system is constructed in such a way that damaged front wheel and rear wheel modules can be quickly replaced by new modules

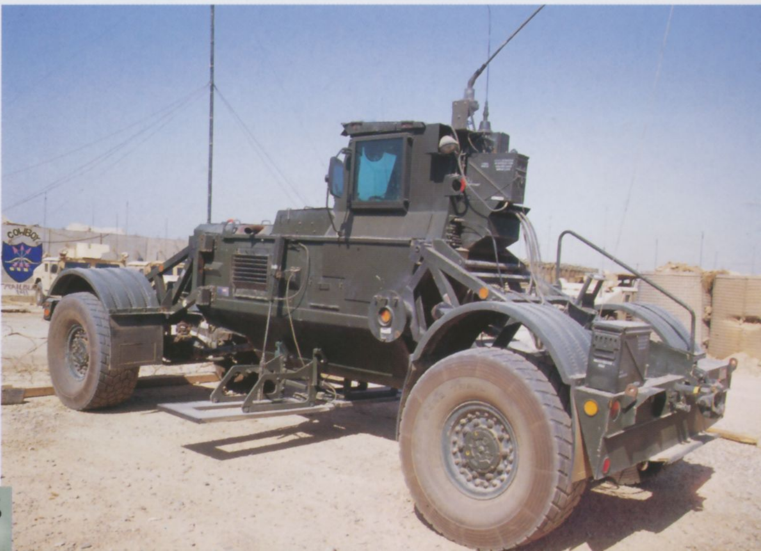
The same Husky T/MDV, this time seen from the rear. Visible is the armor-protected hull of the vehicle, which is made of heavy-gauge armor plates. The driver's compartment features additional ceramic armor and ballistic glass that provides protection from small-arms ammunition up to a caliber of 7.62x51mm even when AP rounds are used. A 6-cylinder water-cooled, direct injection, turbocharged diesel engine powers the Husky.



Rear view of a Meerkat MDV used by the 489th Engineer Battalion and seen at FOB Speicher in June 2004. Like the Husky T/MDV, the vehicle features front and rear wheel modules that are constructed in an open framework design attached to the vehicle body. If damaged by a mine blast, the modules can easily be replaced in the field. According to the manufacturer, replacing the front module under field conditions takes less than an hour. An examination of the manufacturer plate identifies the vehicle as being one made by Rolling Stock Division of South Africa.



Another picture of a Husky Towing/Mine Detection Vehicle. This Husky belongs to A Company, 467th Engineer Battalion, and was seen at Camp Warhorse near Baqubah. Clearly visible are the detection pans under the vehicle's hull, which can be raised or lowered depending on the mission. The Husky four-wheel drive mine detection vehicle is able to clear a 3m wide path while searching for mines and IEDs. But in fact the main task of the vehicle is to tow the series of three different Mine Detection Trailers that will set off mines missed by the detection equipment of the Husky T/MDV and the Meerkat MDV.



Rhino Runner Bus

While standard buses and light vehicles can be converted into armor-protected vehicles by fitting ballistic protection packages, the Rhino Runner Bus is different. Built by Labock Technologies in Florida, the Rhino Runner Bus was custom-made and built from the chassis up so as to achieve this specific mission. Because of this, the bus features reasonable underbody protection, a feature that most other vehicles of similar function lack. The Rhino Runner Bus was initially designed to transport personnel in hostile areas of the Iraqi capital by offering its passengers the highest possible degree of protection. The vehicle offers 360° NIJ Level IV protection. This includes protection from 7.62mm NATO AP ammunition, as well as 30mm AP rounds. Protection is also guaranteed against IED blasts, as well as from splinters of 155mm artillery shells and the like. Front and side windows of the bus are made of bulletproof glass, while the vehicle's body parts are made of specially developed composite armor. As its power source, Labock uses off-the-shelf engines, transmissions and other vital components. As speed also comprises an important aspect of protection, the bus was designed so that it could travel quite fast. For the comfort of its passengers, the bus is fitted with an air-conditioning system. Seating is provided in rows of three seats inside the bus. Each row of seats is divided by a center aisle, with two seats situated to the left of it on the driver's side, and the third seat placed on the right. The bus has a side and back door and an emergency exit in the roof. Run-flat tires are part of the safety equipment. Initially, five Rhino Runner Buses were operating in Baghdad. In December 2004 the U.S. military ordered another eleven buses.

Rhino Runner under attack

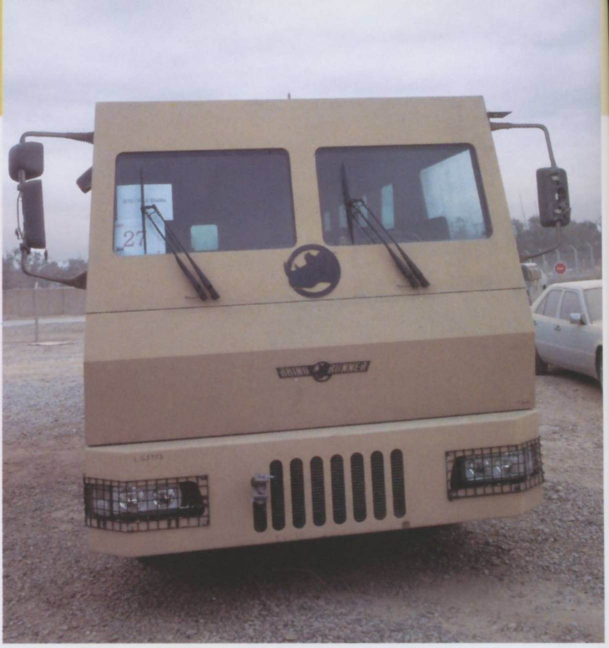
Under the cover of darkness early in the morning of 27 November 2004, the convoy of three Rhino Runner Buses rushes along "Route Irish", the infamous road that connects Baghdad International Airport with the city center. Attacks on coalition forces happen on a daily basis on this vital seven-mile long road. In addition to IEDs planted on the roadside, there are also RPG and small-arms attacks, and SVBIED attacks are also regular incidents. Suddenly out of nowhere, a BMW rushes alongside the convoy and veers between the first and second buses. When only two meters in front of the second bus, the driver sets off the large amount of explosives (later estimated to be around 1,000lbs) packed inside the car. The scenery erupts in flames, and a 1,000-foot long dust cloud covers the area where the huge explosion generated a crater some six feet wide and two feet deep. The blast of the explosion was so strong that the engine, the only solid part of the attacking vehicle that remains, was thrown 100 yards away. Despite the point blank explosion, the driver and seventeen passengers traveling inside the bus closest to the explosion received only minor injuries and some damage to their eardrums. According to a spokesman of the Joint Area Support Command during another sortie between the Green Zone and BIAP, a Rhino Runner Bus was also hit by an RPG. While some damage was caused to the bus, again its passengers were unharmed. In both incidents the buses were damaged, but after repairs they returned to service. The Rhino is not only used as a shuttle bus for it is also employed for VIP transport. During his visits, U.S. Secretary of Defense, Donald Rumsfeld, traveled in the Rhino Runner Bus, and one bus was also used to drive Saddam Hussein and other VIP prisoners from their prison to court.

Technical Data for Rhino Runner Bus

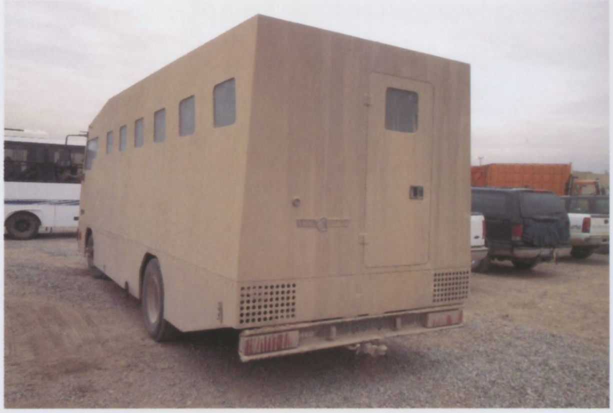
Crew:	1+17 (driver and passengers)
Combat weight:	11,700kg
Armor protection level:	NIJ IV
Manufacturer:	Labock Technologies, Florida. Production is carried out at the company's plant in Ashdod, Israel.

RHINO RUNNER

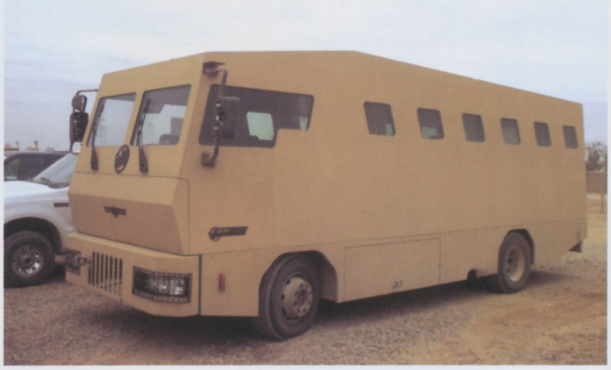
Detail picture of the "Rhino-Runner" logo featured on the armored buses manufactured by Labock Technologies, Florida.



Front view of the well-protected Rhino Runner Bus. Made of composite armor and fitted with windows of bulletproof glass, the vehicle offers protection against threats up to NIJ IV-level for its driver and passengers. So far, no bus has been lost in Baghdad. The buses have proved themselves in several incidents involving IEDs, small-arms fire and even the most deadly of SVBIEDs. While receiving some sort of damage up till now, all buses returned to duty after repairs.



Rear view of one of the first five Rhino Runner Buses to operate in Baghdad. The door situated in the rear is visible. Another access door is situated on the right halfway down the side of the bus. Due to the threat level in Baghdad, particularly on "Route Irish", the armored buses mostly run their sorties at night.



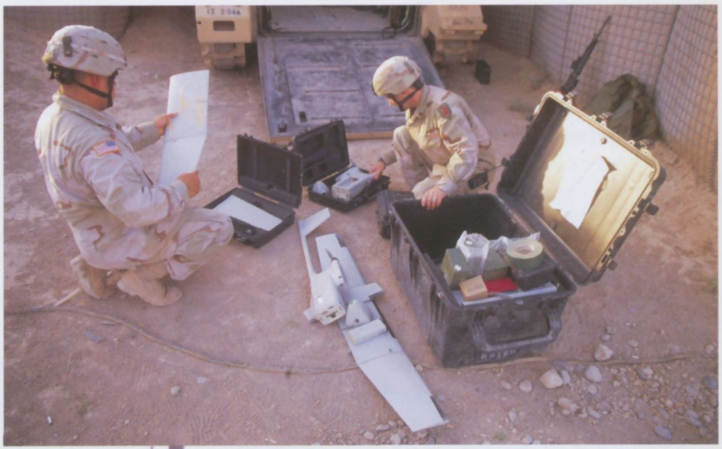
This Rhino Runner Bus was seen at the military sector of Baghdad International Airport in December 2004. The armor-protected vehicle offers 360° protection up to NIJ Level IV. While it is available from Labock Technologies Incorporated in three different configurations, the pictured Rhino Runner is the seventeen-passenger bus model. In Baghdad the "Rhino-Bus" is used to transport troops from BIAP to the International Zone in the city center.

In recent years UAVs such as the Shadow 200 Tactical Unmanned Aerial Vehicle have entered the U.S. Army reconnaissance and intelligence equipment inventory in larger quantities. Previously operated at the corps, division and brigade level, the conflict in Iraq saw UAVs being fielded for the first time at lower levels. Since 2004, several reconnaissance, armor, artillery and mechanized infantry units deployed to Iraq have been equipped with the Raven SUAV. Although it was originally planned for deployment at the company level, manufacturing shortages meant that the SUAV was initially employed at the battalion level. The small hand-launched unmanned surveillance aircraft provides unit commanders with their own airborne reconnaissance asset. The Raven provides a unit commander with a real-time, up-to-date, over-the-horizon view that is available day and night. That view is provided in the form of video coverage. In addition, commanders no longer need to wait in the priority line for a higher level UAV asset. With its own Raven UAV at hand, units have the ability to perform almost immediate, on-demand, over-flights of areas of concern for highly detailed, real-time intelligence. This can be done without risking any soldier's life. In Iraq the Raven SUAV is mainly used to patrol roads in a search for IEDs and insurgents, as well as to gather vital information on target areas in preparation for raids and search operations.

Raven TUAV development and fielding

In 1999 the U.S. Army purchased some Pointer UAVs from Aerovironment Incorporated in order to evaluate them for their potential use in Military Operations in Urban Terrain (MOUT). Pointer was the first hand-launched, backpack-transportable UAV to become available, and it was a pioneer on the SUAV market. Pointer UAVs were found to be extremely useful, but their control equipment was too heavy. Subsequently, Aerovironment Incorporated began developing a new SUAV. A concept demonstrator, called the Flashlight, made its maiden flight in October 2001. In 2002, further development led to the building of a prototype of the Raven SUAV. Low Rate Initial Production began in early 2003 and the first series production Raven SUAV entered service in May of the same year. Compared to the prototype, the LRIP Raven UAV had some modifications and was therefore consequently called Raven SUAV Block I. The modifications included a new fuselage section as well as an easily interchangeable nose section. Again the SUAV underwent tests, and future improvements were made regarding mission flight stability and launch procedures.

In September 2003 the Raven SUAV Block II was deployed for the first time to an operational theatre. This was with the 10th Mountain Division in Afghanistan, where it was evaluated under operational conditions. After its successful operational deployment, the SUAV was officially type classified as RQ-11A Raven SUAV in late 2004. At this time the first three batches of some 185 Raven SUAVs had already been ordered and partly fielded by SOCOM. It is believed that the U.S. Army has ordered some 1,100 RQ-11A Raven SUAV systems, including 3,300 aircraft with an estimated price of US$250,000 for each system, and an aircraft price of US$35,000 each. Fielding of the RQ-11A was carried out by units already deployed to Iraq and Afghanistan. Therefore, training was conducted in-theater, namely at a training facility run by a civilian contractor in Kuwait. Soldiers selected by their units were given an aptitude profile before being trained as operators. Among the future operators were infantrymen, tank drivers and clerks, and even cooks. Training them into skilled SUAV operators took two weeks, a fact that illustrates just how easy it is to handle the Raven. This is also proven by the fact that freshly trained operators only need seven minutes from the landing of an RQ-11A until they re-launch it on another mission. So far, some RQ-11As have been shot down, while others disappeared after the aircraft lost contact with the Ground Control Station (GCS). However, this does not reduce the outstanding performance record of the SUAV. In Iraq, RQ-11As were fitted with a bilingual label in Arabic and English that read: "If found, return to the nearest coalition forces base for a reward". Some of the lost SUAVs were indeed returned due to this label after being found by locals.

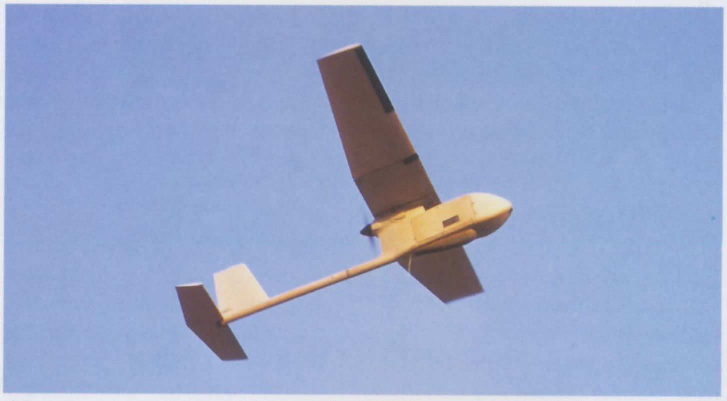


Usually stored in one large cargo box, the RQ-11A Raven SUAV system consists of three complete aircraft, the Ground Control Station, spare batteries and battery charger, and spare parts. For dismounted use, the required mission equipment can be stored in three smaller transport cases, of which two can be seen in this photo being prepared for an operation by soldiers. Note the disassembled RQ-11A in front of the transport box.

The RQ-11A Raven SUAV during flight missions is usually remotely controlled by its operator using the Ground Control Station. If required, completely autonomous missions using preprogrammed GPS waypoint navigation can be conducted.

Prior to a reconnaissance mission in Iraq, a U.S. Army RQ-11A Raven SUAV operator conducts pre-flight checks. Visible is the twin-bladed propeller that is driven by an Aveox 27/26/7-AV electric motor. The Raven SUAV is driven through the air by the propeller pusher system.

Launching the RQ-11A Raven SUAV is achieved out of the hand like a model plane. This allows the use of the SUAV even in mountainous terrain where no flat ground for a launch site is available. Ideally the launch is done from a raised spot, and in this case a soldier of 2nd Battalion, 34th Armor Regiment, uses an M577 command post vehicle as his launch platform.



After a successful launch, an RQ-11A Raven SUAV climbs into the sky for a road reconnaissance mission in the Baqubah region. The aircraft has a wingspan of 1.4m, is 0.9m long and weights 1.9kg. The RQ-11A is battery powered, and depending on the power level of the battery, it can conduct missions up to 110 minutes long within a 10km range.

Technical description of the RQ-11A "Raven" SUAV

Each of the Raven systems fielded includes three aircraft, a Ground Control Station, a Remote Video Terminal, and three small storage boxes that can be carried in a rucksack. In this way the SUAV can thus be fielded by troops operating when dismounted and separated from their motor transport. The system and the boxes are stored in a large cargo box that also contains spare parts, rechargeable lithium ion battery packs, and a battery charger with connection cables, one of which can be fitted into the 28V DC outlet that is available in every HMMWV. The RQ-11A is battery-powered and can operate with single-use batteries (80 to 110 minutes' duration) or rechargeable batteries (60 to 90 minutes' duration). The batteries power the SUAV's Aveox 27/26/7-AV electric motor, to which a twin-bladed propeller is connected. The engine is powerful enough to provide the SUAV with a top speed of 57km/h, allowing the vehicle to reach a maximum operational altitude of 14,000ft. The engine and propeller assembly is of the pusher type and is placed at the top rear of the aircraft body. The battery pack is mounted on the right side of the airframe.

The body is made of a composite material containing Kevlar. This guarantees a minimum of 200 tactical landings before it might eventually break. The deep stall vertical landing method is used to land the SUAV. When hitting the ground the aircraft usually breaks apart, and in this way some of the impact shock is absorbed. The Raven SUAV does not possess any landing gear and no large landing site is required. Assembling the 1.9kg SUAV prior to a mission can be done in minutes. The SUAV consists of the three-part main wing assembly, the aircraft body, the tail, the tail wing, the battery pack, and the aircraft nose that incorporates the sensor package. Assembled, the aircraft has a wingspan of 1.4m and a length from nose to tail of 0.9m. The sensor pack can contain a CCD color video camera or an infrared camera. The images captured by the cameras are broadcast in real-time back to the RVT and the GCS of the operator, who might be located with the command element running the operation. For data transmission the SUAV is equipped with sophisticated communication systems. The SUAV is launched by simply turning on the electric motor and then throwing the aircraft into the air. Once launched, the RQ-11A can be flown by manual remote control from the GCS, or completely autonomously using GPS waypoint navigation. Typically the aircraft is operated at altitudes of between 30 and 300m with a cruising speed of 40 to 50km/h. In the case of an emergency, the SUAV can be ordered to immediately return to its launch point simply by pressing a single command button on the GCS.

Technical Data for RQ-11A Raven STUV

Vehicle type:	Small Unmanned Aerial Vehicle for battlefield reconnaissance
Length:	0.9m
Wingspan:	1.4m
Maximum takeoff weight:	1.9kg
Engine:	Aveox 27/26/7-AV electric motor
Speed:	20 to 57km/h
Flight ceiling:	14,000ft
Sensor package:	CCD color video camera or IR camera
Range:	10km (line of sight)
Recovery method:	Deep stall vertical landing
Navigation system:	GPS-supported using waypoints
Endurance:	60 to 90 minutes with rechargeable batteries, or 80 to 110 minutes with single-use batteries
Launch method:	Hand-launched
Unit cost:	US$35,000 per aircraft; total system price including three aircraft is US$250,000
Manufacturer:	Aerovironment Incorporated

Shadow 200 Tactical Unmanned Aerial Vehicle

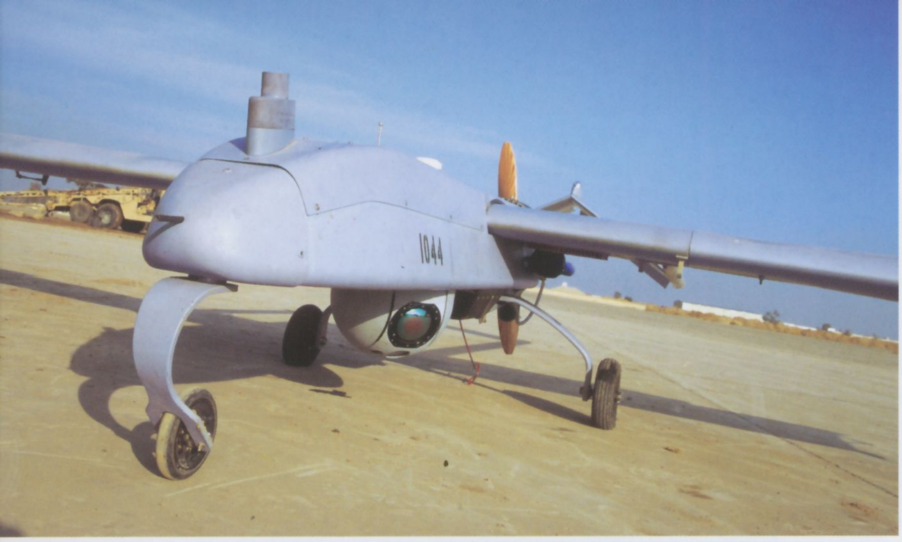
The development of the Shadow 200 TUAV took only thirty-three months from the original program initiation to its full-rate production decision by the U.S. Army in September 2002. During this period, more then 1,000 Shadow flights were conducted, totaling some 2,000 flight hours, with the prototypes achieving an operational availability rate of 95%. Authorization for the Shadow 200 TUAV program to enter into full-rate production was the first such decision ever for any of the U.S. Armed Services TUAV programs. The first Shadow 200 systems were fielded by the cavalry squadrons of the Stryker Brigade Combat Teams at Fort Lewis, Washington, in October 2002. In total the U.S. Army plans to buy forty-four Shadow 200 TUAV systems, of which the last will enter service in 2009. In early 2006, over 50% of the systems ordered had been delivered. Of these, four systems are operated by the U.S. Army TUAV School at Fort Huachuca, Arizona, while the remainder serves with U.S. Army and National Guard operational units.

Each system consists of four Shadow 200 TUAVs, one hydraulic rail launcher, two Ground Control Stations, two Portable Ground Control Stations, two Remote Video Terminals and a mobile maintenance facility. The whole Shadow 200 TUAV system is transported in six S788 Type Shelters (Lightweight Multi-Purpose Shelter) mounted on M1113 HMMWV ECVs. Within the future structure of the U.S. Army based around brigade-sized forces (called Units of Action), each will have a Military Intelligence Company with a TUAV platoon equipped with one Shadow 200 TUAV system. The platoon consists of twenty-two soldiers, of which thirteen are trained operators while seven are maintainers and two are command supervisors. During a mission, the Shadow 200 GCS is manned by an air vehicle operator who monitors flight instruments and can change the preprogrammed flight path. The payload operator programs the search pattern and steers the electro-optical sensors while the mission commander communicates with the regional air traffic control, coordinates with the units being supported, and supervises the UAV operators. A whole Shadow 200 system and its crew can be transported into an operational area aboard three C-130 Hercules transport aircraft.

The Shadow 200 TUAV air vehicle is constructed of aluminum and composite materials. The tactical lightweight UAV is powered by a commercial 38hp rotary engine. The RQ-7A features a twin-boom pusher layout. The Shadow 200 TUAV uses standard takeoff procedures or it can be launched from a hydraulic rail launcher. The latter is the common practice in Iraq, as this allows the Shadow TUAV unit a higher flexibility in choosing an appropriate launch site during field operations. The required takeoff distance when using a launcher is 10m. The Shadow 200 TUAV lands conventionally on its non-retractable tricycle landing gear. A flat surface about the length of a soccer field is required for landing. The distance can be shortened by the use of a deployable arresting hook on the aircraft and ground-based cables.

Flight control is exercised by a HMMWV-based Ground Control Station. From there the Shadow can be controlled by the use of a preplanned flight path using waypoints, or it can be directly controlled by an operator. Onboard GPS instrumentation provides navigational information and allows autonomous operations. When the Shadow 200 TUAV is deployed in direct support of a ground unit, a Portable Ground Control Station can be deployed with the unit in order to allow more direct support. In such a case, control of the Shadow 200 TUAV is handed over from the GCS to the PGCS when it enters the airspace of the operational area. The PGCS also has full functional control to launch and recover the air vehicle, operate the payload, and receive and display gathered data. By the use of the RVT, forward battle commanders can monitor the area of operation using a flat-screen display in near real-time. Both LOS (Line-Of-Sight) and non-LOS data links are provided for command uplink and sensor data downlink.

Mobility for the Shadow 200 TUAV system is provided by six M1113 HMMWV ECVs that have S788 Type Shelters mounted in their cargo bays. The shelters are stuffed with electronics such as the GCS, but as seen in this picture, they are also used for storing the TUAVs and their maintenance equipment.



This Shadow 200 TUAV was used by the 312th Military Intelligence Battalion based in Taji in December 2004. Observable under the main fuselage of the TUAV is the IAI Tamam POP (Plug-In Optronic Payload) IR/EO (Infrared/Electro-Optical) sensor turret. The Shadow TUAV has a payload of 27.2kg and a maximum gross vehicle weight of 148.8kg.

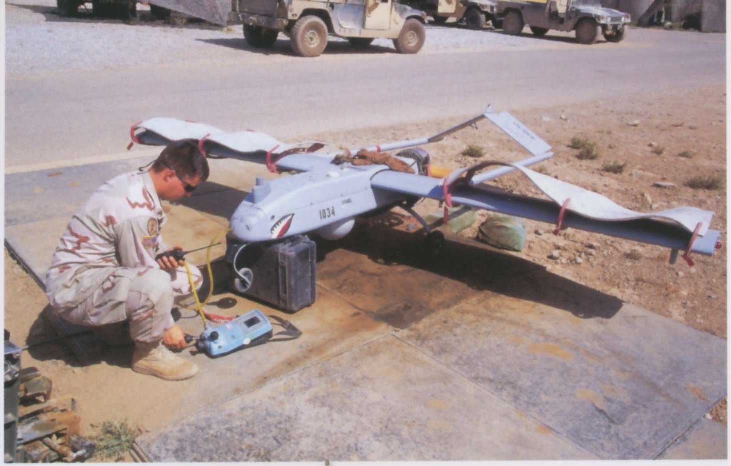
The primary mission payload for the RQ-7A is an IAI Tamam POP (Plug-In Optronic Payload) IR/EO (Infrared/Electro-Optical) sensor turret. But the 60lb intelligence-gathering payload of the Shadow 200 TUAV may also contain a marker/illuminator kit, laser rangefinder and target designator kit, a communications relay package, or a synthetic aperture radar/moving target indicator. During daylight, the Shadow 200 TUAV usually operates at a mission altitude of 8,000 to 10,000 feet, but during the night this drops to 6,000 to 8,000 feet. With its standard mission payload the RQ-7A is able to recognize a tactical vehicle from a height up to 8,000 feet above the ground at an oblique range of more than 3.5 kilometers. The Shadow 200 TUAV is able to provide targeting data for precision weapons using "leap ahead" technology. In its first operational year in Iraq during Operation Iraqi Freedom, the U.S. Army Shadow 200 TUAV (which is also called RQ-7A) flew more than 2,000 sorties and accumulated more than 8,800 flight hours while performing surveillance and reconnaissance missions in support of coalition ground forces. In total the Shadow 200 TUAV had accomplished 3,834 missions with a total of 12,706 flight hours by 25 July 2004.

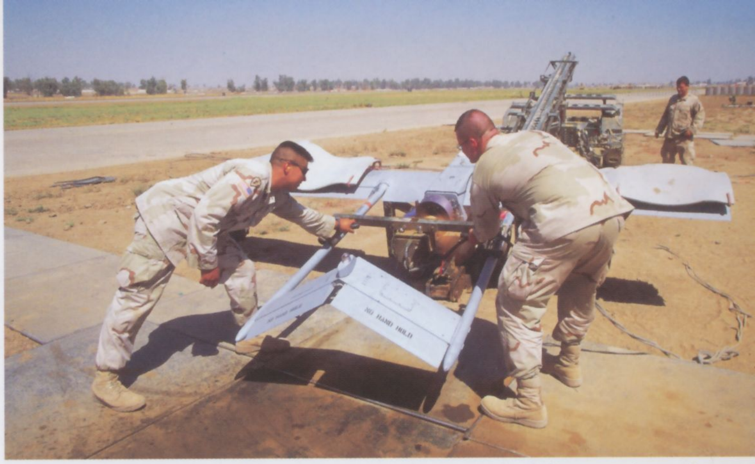
Technical Data for RQ-7A Shadow 200 TUAV

Length:	3.4m
Wingspan:	3.89m
Maximum gross vehicle weight:	148.8kg
Payload:	27.2kg
Engine:	UEL AR 741 206cc commercial rotary engine
Engine performance:	28.3kW (38bhp)
Maximum altitude:	4,570m (15,000ft)
Maximum speed:	123knots
Cruise speed:	65 to 85knots
Navigation:	Preprogrammed, autonomous or direct control
Sensor package:	IAI Tamam POP IR/EO sensor turret
Range:	120km (limited by data link capability) or 5.1-hour flight time
Fuel capacity:	37 liters of AV Gas
Variants:	- RQ-7B: In production since August 2004; larger wings with more efficient airfoil and increased fuel capacity, endurance of over 6 hours, upgraded avionics, larger tail, new sensor package with additional capabilities (Wescam EO/IR sensor or SAR/MTI [Synthetic Aperture Radar/Moving Target Indicator]), fitted with Tactical Common Data Link (TCDL) and Internal Measurement Unit (IMU). - Shadow 200-T: Exchanges the original pusher engine for a more powerful puller engine mounted on the nose.
Manufacturer:	AAI Corporation (USA)

Members of the 312th Military Intelligence Battalion prepare a Shadow 200 TUAV for launching. One of the procedures carried out during launch preparations is the starting up of the 28.3kW UEL AR 741 206cc commercial rotary engine. The wingspan of the Shadow TUAV is 3.89m, while the aircraft is 3.4m long.

A Shadow TUAV has just returned from a reconnaissance mission. When landing its hook missed the arresting gear cables on the ground, and consequently it was stopped by the arresting net on the runway. The front wheel is still entangled in the net, while another net can be seen set up in the background. Soldiers of D Troop, 2nd Squadron, 14th Cavalry Regiment, are already conducting the first post-flight maintenance work.


A soldier of D Troop, 2nd Squadron, 14th Cavalry Regiment, conducts preflight checks on a Shadow TUAV. The wings of the TUAV are protected by covers in order to prevent any of the fuel stored inside from overheating due to the sunshine and high summer heat in Iraq. Note the shark's mouth and crossed sabers painted on the nose of the aircraft.

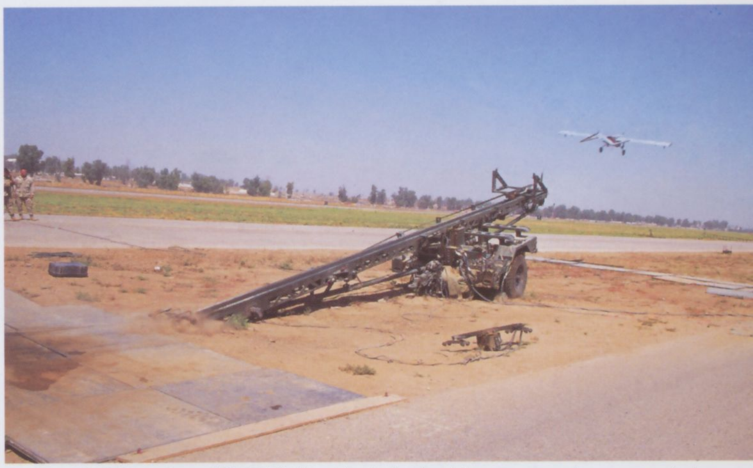

Prior to a launch, soldiers have just jumpstarted the engine of a Shadow 200 TUAV. The aircraft has already been placed on the hydraulic rail launcher. Belonging to D Troop, 2nd Squadron, 14th Cavalry Regiment, the TUAV was seen in early August 2005. The unit conducted some 801 missions in Iraq between 13 October 2004 and 31 July 2005. In June 2005 alone, some 550 flight hours were clocked up by the unit in 110 missions. The unit has only three Shadow 200 TUAV aircraft in its inventory, a fact that demonstrates the high rate of mission availability of the TUAV.

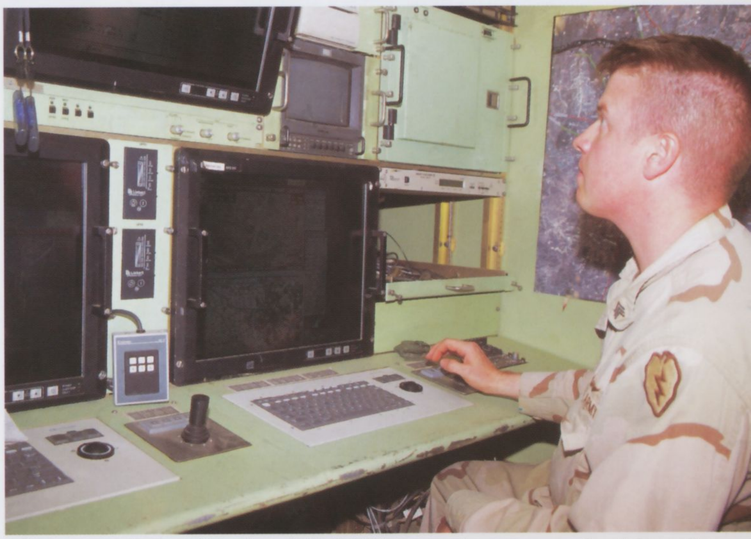
Shadowing a mortar attack

The slightly out-of-focus grayish picture on the screen of the Remote Video Terminal shows a white Nissan pickup parked in a field. A group of five people is visible as black spots next to the vehicle. Just minutes ago the men had arrived in the area, unloaded their mortars and prepared them for another indirect fire attack on U.S. troops. Now they man their two mortars and can be seen dropping the first rounds into the barrels. A split second later the blast produced by a mortar round leaving the weapon is visible on the screen. What the men do not know is that their activity is being monitored by the watchful electronic eye of a UAV.

With its UAVs the Military Intelligence unit (to which the small remote controlled aircraft belongs) has monitored the suspects' pickup truck for an entire week now. From the air it was recorded when the driver took the vehicle and picked up his co-conspirators. The operator behind the Remote Video Terminal had watched them picking up the mortars and ammunition from a mosque. Then the operator saw them driving to their firing position and setting up their deadly indirect fire weapons. In the center of the picture, laid on the pickup, white crosshairs can be seen. The scene is being filmed by the Day/Infrared TV camera of the Shadow 200 TUAV. The people in the picture belong to an Iraqi insurgent group and they were conducting yet another mortar attack on FOB Eagle in the east of Baghdad, near Sadr City. It is 29 September 2004, and in the last month the camp has been hit by 957 mortar rounds, while another 400 rounds had their impact points outside the camp. To the side of the picture that is being transmitted by the Shadow 200 TUAV is a grid reference, flight altitude and other data. Suddenly the Nissan pickup, the mortar position and the surrounding farmland erupt in a fireball and puffs of smoke can be seen everywhere. The mortar position, which was just 1,100m away from the U.S. camp, has been hit by a 155mm artillery shell fired by an M109A6 Paladin self-propelled howitzer, with its fuse set in an airburst mode. The counter-battery fire was directed by the target information given by the Shadow 200 TUAV. After the dust and smoke has settled the TUAV picture reveals the effects of the direct hit - three of the Iraqi fighters lie motionless on the ground and the pickup truck is left in shattered pieces. The two other insurgents can be seen trying to crawl away.

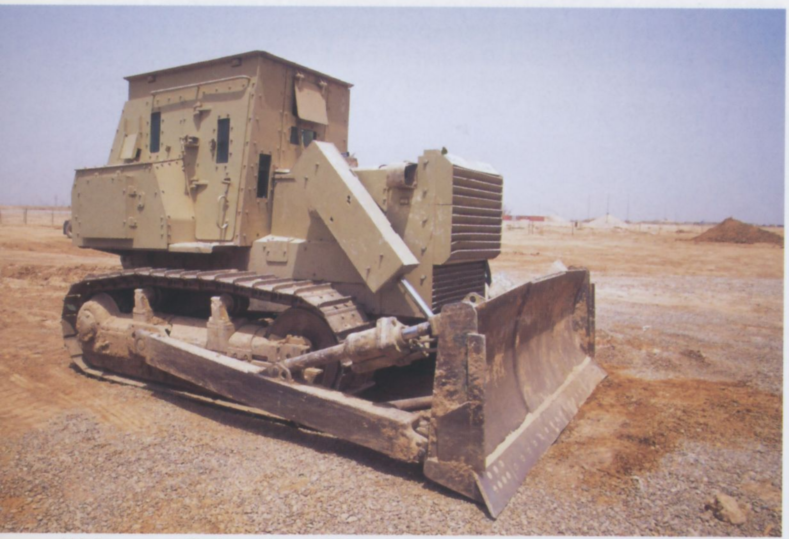
Up till December there had not been another mortar attack on Camp Eagle. This story illustrates well the mission and capabilities of the Shadow 200 TUAV, which is the current brigade-level Tactical Unmanned Aerial Vehicle of the U.S. Army. The Shadow 200 TUAV provides U.S. Army ground commanders with a primary day/night reconnaissance, surveillance, target acquisition, and battle damage assessment system that provides near real-time information.


"Lift off!" A Shadow 200 TUAV has just started its reconnaissance mission over Mosul in northern Iraq in August 2005. The Shadow 200 TUAV has a range of 120km and can stay in the air for 5.1 hours. Launched from the hydraulic rail launcher located at Mosul airport, the TUAV belongs to D Troop, 2nd Squadron, 14th Cavalry Regiment.

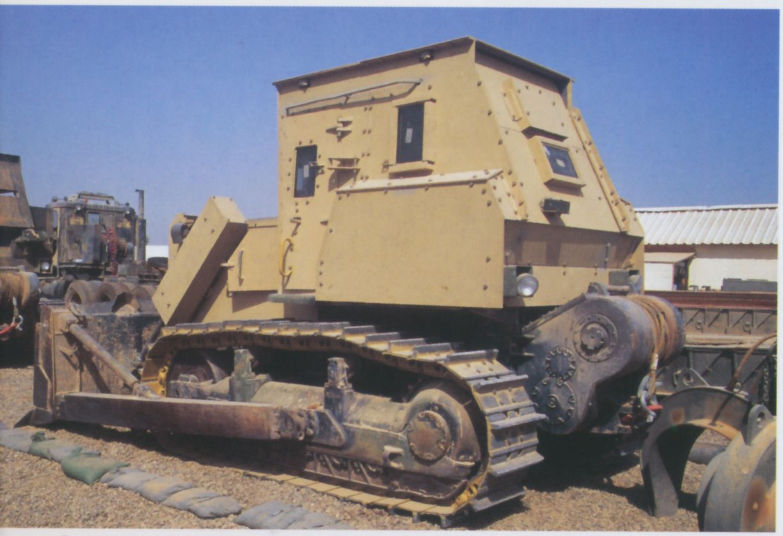

Mission control of Shadow 200 TUAV operations is exercised from the GCS situated inside an S788 Type Shelter mounted on an M1113 HMMWV ECV. Flying of the TUAV is done with a joystick. On the screens in front of the operator is a map with the location of the TUAV, as well as the video images taken by the camera. The digital footage is recorded and inside the container a printer is located that allows the printing of single pictures

U.S. Army D7G and D9R Bulldozer

The Caterpillar D7 bulldozer has been part of the inventory of engineer units of the U.S. Army for decades. In production since the 1930s, the original Caterpillar D7 bulldozer series has been upgraded periodically over the years, and at the time of writing the most advanced version was the D7R Series II. Officially the D7G is known in the U.S. Army as follows: Full Tracked, Low Speed, Medium Drawbar Pull, T9 Size, Caterpillar Model D7G. While it has been replaced on the frontlines since the late eighties by the M9 Armored Combat Earthmover, the D7G remained the prime earthmoving and construction work asset within division and corps level engineer units. Since 1995, hundreds of D7F and D7G bulldozers of the U.S. Army underwent a SLEP which included replacing worn parts, the internal re-bearing and resealing all of the vehicle systems, as well as replacing hydraulic hoses and wiring harnesses. This will extend their service life in the U.S. Army by another fifteen years. Fitted at the front of the vehicle is a hydraulically operated straight universal blade with a tilt cylinder, while at the rear either a ripper, winch, or towing hook, can be mounted.



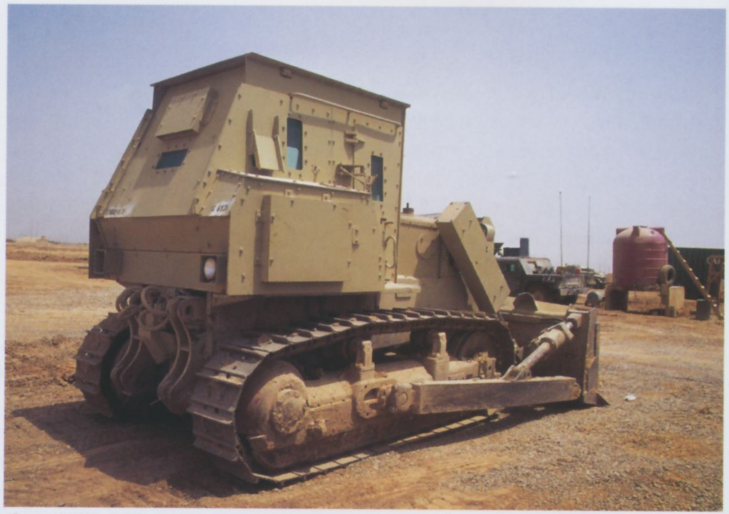
While most Caterpillar D7G bulldozers operated by the U.S. Army in Iraq either feature no armor at all or have been up-armored at the unit level, the pictured vehicle is one of the rarer ones fitted with the Mine Clearing/Armor Protection kit. The MCAP kit was developed prior to the 1991 Gulf War. Made of homogeneous steel, the armor protects the crew compartment of the bulldozer as well as the engine, the hydraulic system, the fuel tank and the cooling system. The pictured vehicle belongs to the 467th Engineer Battalion and was seen in Camp Summerall outside Bayji in August 2005.



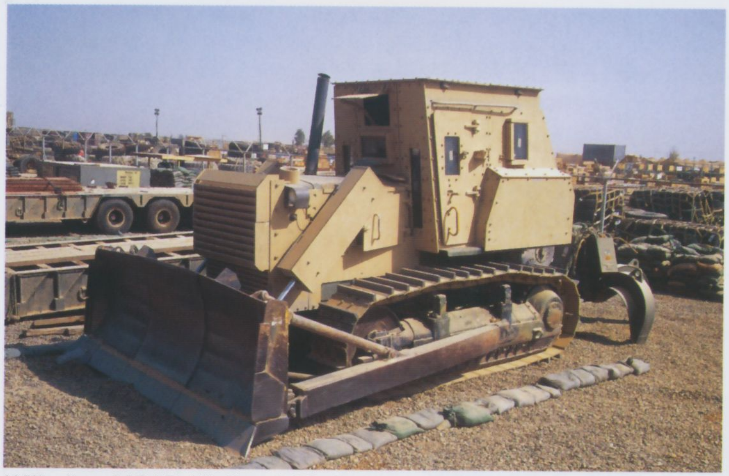
Belonging to an unknown engineer unit, this D7G fitted with MCAP was seen at LSAA in late July 2005. Note that the armor package fitted to the bulldozer differs in some ways from the other vehicle shown in this book. The armor package on this vehicle features thicker ballistic glass and the small openings to the rear of the side vision ports are missing.

Considerably changing its standard appearance, several unarmored D7Gs were fitted with the Mine Clearing/Armor Protection kit prior to the 1991 Gulf War. The MCAP kit was developed and manufactured by Caterpillar under an urgent procurement request from the Tank Automotive and Armament Command. The aim of the kit was to equip the D7G for mine- and UXO-clearing operations. The MCAP kit included an angled rake assembly and an armored crew cab. Without armor the D7G has an operational weight of 20,094kg, but the armor kit adds some 3,084kg to this. The U.S. Army deployed D9 bulldozers for the first time during the Vietnam War in the 1960s. After the war the D9s were decommissioned in favor of the much lighter D7 bulldozer.

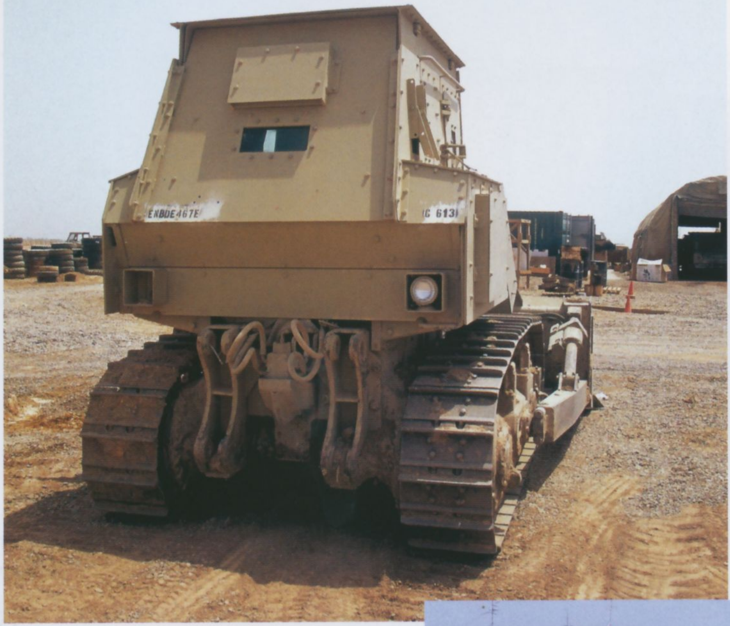
During the buildup to Operation Iraqi Freedom in 2003, the U.S. Army purchased fourteen armored Caterpillar D9R bulldozers from Israel. The bulldozers were present when U.S. forces breached Iraqi border defenses in March 2003. Originally the bulldozers were purchased in anticipation of heavy fighting in Iraq's built-up areas. The U.S. Army's decision to



Consisting of a number of armored panels made of homogeneous steel, the MCAP protects the D7G operator from the effects of 7.62mm AP projectiles and fragments from IEDs or artillery shells. Visibility for the operator is provided by eight vision ports made of bulletproof glass. The crew cab can be entered by two doors and is ventilated by two fans. Service access doors in the armor allow quick maintenance work on the engine to be conducted.

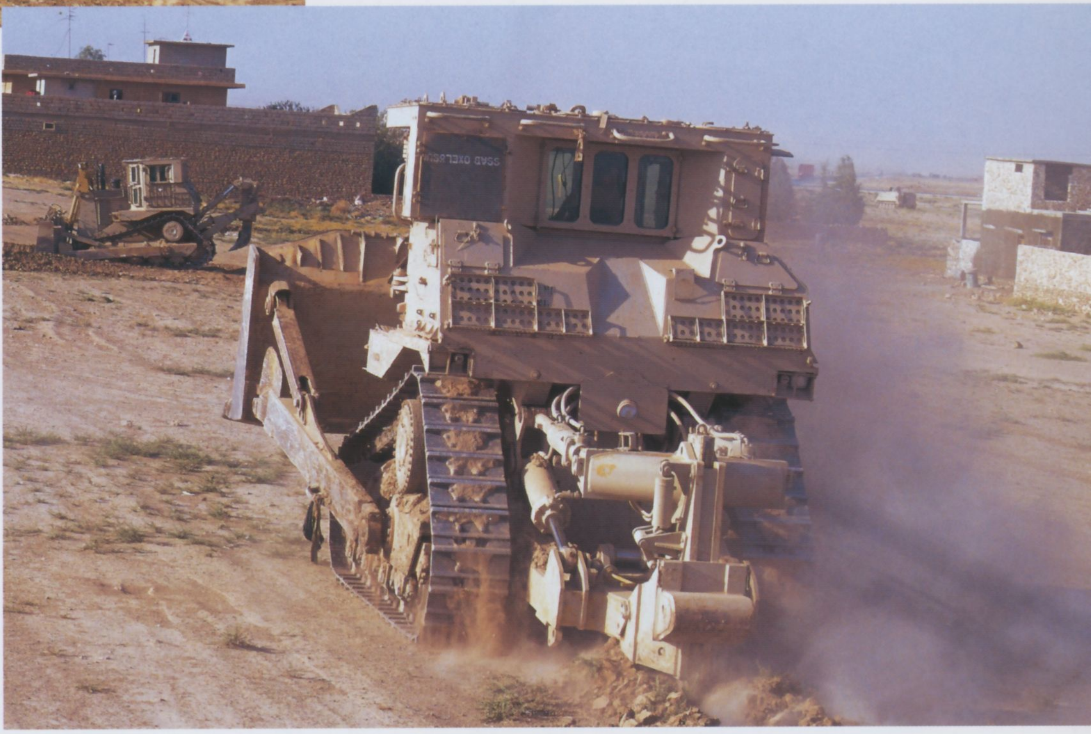


With the MCAP kit the D7G has a combat weight of 23,178kg. Powering the bulldozer is a 3306T diesel engine that develops a flywheel power of 200hp. Normally used for earthmoving, the D7G is equipped with a front-mounted hydraulically operated straight universal blade with a tilt cylinder.



Rear view of the 467th Engineer Battalion's D7G bulldozer fitted with an MCAP kit. Note the rear mounting point and hydraulic lines. Like other bulldozers, the D7G can be fitted at the rear with a hydraulic winch or a hydraulically operated ripper.

The monster bulldozer at work - a D9R of Task Force "Big Nasty" works on the Tall Afar berm. With its large U-Blade the bulldozer is able to move 16.4m³ of earth, sand or gravel at a time. According to claims from soldiers of U.S. Army engineer units, one D9R is able to do the work of four D7 bulldozers in the same amount of time.

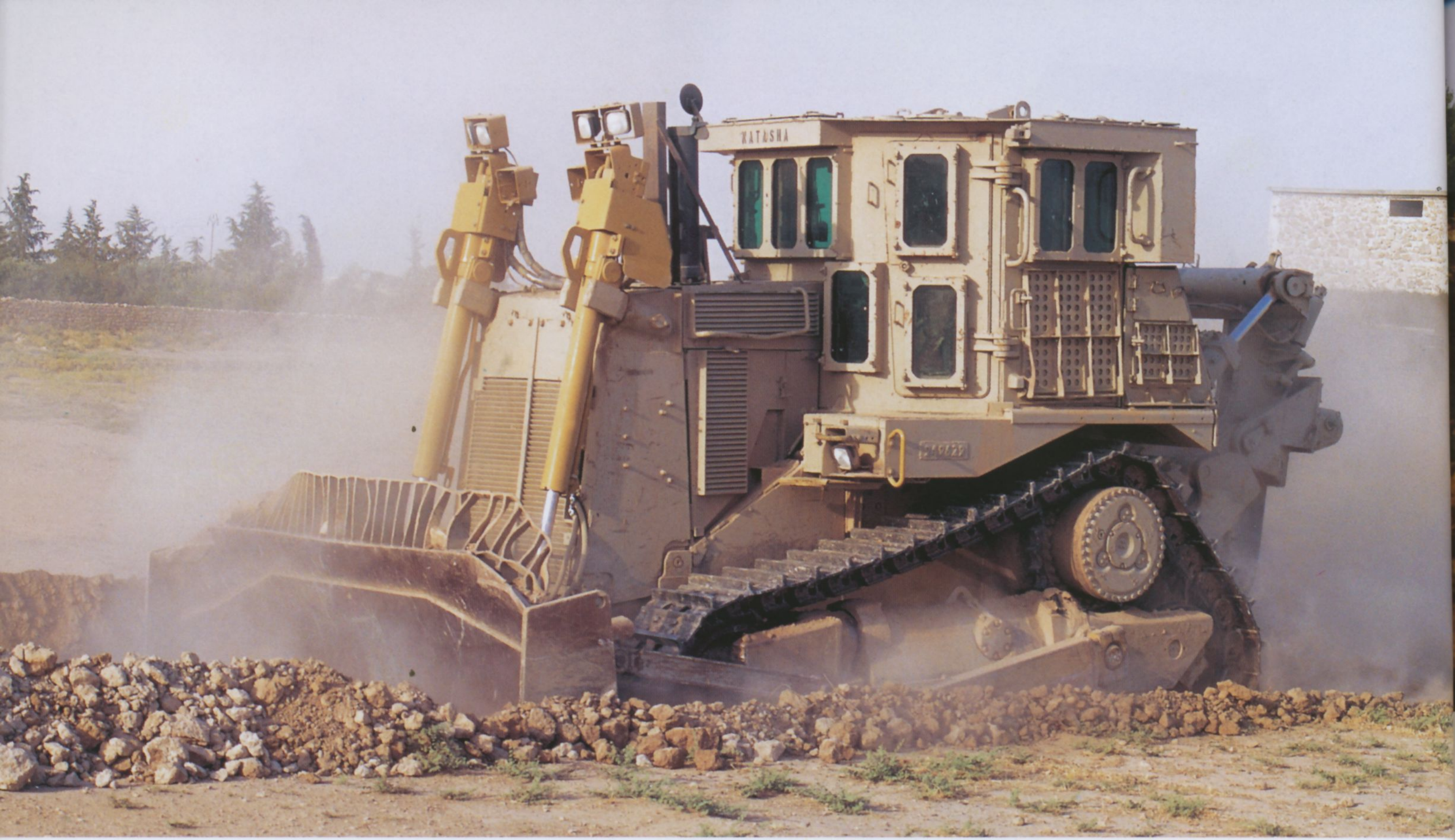


A large ripper is mounted at the rear of U.S. Army D9Rs. With the ripper it is possible to open hard or deeply frozen ground or to dig small ditches. The hydraulically operated ripper can penetrate the ground to a distance of 1.7m. The picture shows "Scarface", a D9R belonging to Task Force "Big Nasty", opening the hard desert ground in the Tall Afar region.

purchase D9s was based on the experiences of the Israeli Army during fighting in Jenin and other towns of the Gaza Strip and the West Bank. It was here that the Caterpillar bulldozers demonstrated their abilities when removing barricades, clearing minefields and IEDs, breaking their way into barricaded houses in which the enemy was positioned, or simply breaching ditches and berms to allow armored vehicles to push through the gaps. It is known that in May 2003 a minimum of nine D9R bulldozers were being operating in Kuwait and Iraq by the U.S. Army.

U.S. engineers claim that one D9 is able to do the work of four D7 bulldozers. In addition to its outstanding engineering performance, with an IMI add-on armor kit fitted, the D9R provides its crew with a high degree of protection. The armor provides protection for the vehicle's external hydraulics, the mechanical systems, and the operator's cab. The cab armor, which features windows of bulletproof glass, can withstand a direct hit from 12.7mm ammunition. The armor protects the crew from the effects of mine blasts, and is able to stop 155mm artillery shell splinters. During operations, armored D9s of the Israeli Army are claimed to have even withstood the effects of RPGs.

The D9 series of heavy tracked tractors, more commonly referred to as bulldozers, has been produced by Caterpillar Incorporated, USA, since 1955. Since its first public appearance, the D9 (then called D9B) has undergone several enhancements. The current versions of the bulldozer are the D9R and D9T. Older versions such as the D9L or D9N are also still in common use worldwide. Until the introduction of the D10 in the 1980s, the D9 was the largest bulldozer manufactured by Caterpillar. As the latest D9 versions (namely L, N, R and T models) differ basically only in their internal systems, they are hard to differentiate from each other. The D9L was the first version of the D9 featuring a "High Drive" design, which provides the vehicle with a greater ground clearance. In the "High Drive" design the drive sprocket is located higher then the other road wheels. The primary working tool of the D9R is the front-mounted hydraulically operated dozer blade. Two hydraulic arms are used to lift and lower the blade. A large hydraulically operated ripper is mounted at the rear of the D9R. The dozer blade can be used for earthmoving, pushing up sand, dirt and rubble. In the military it is also used to clear barricades or to push vehicles such as destroyed battle tanks to one side. The rear ripper is intended for use in loosening rocky ground and ripping out large stones. It can also break frozen ground and excavate small ditches. Hydraulically controlled, the single-shank blade of the ripper can penetrate 1.7m deep into the ground. The ripper can be replaced with a multi-shank ripper, allowing the bulldozer to comb the ground. The dozer blade can also be exchanged for a mine plough.



The D9R is over 4m high and 8.1m long. Powering the Caterpillar D9R is a 3408E HEUI 8-cylinder 18-litre diesel engine that provides the bulldozer with a flywheel power of 410hp. The D9R can reach a maximum forward road speed of 11.9km/h, and when driving in reverse, a top speed of 17.7km/h is possible. Pictured is "Natasha", a D9R of Task Force "Big Nasty".

Technical Data for Caterpillar D9R Bulldozer

Vehicle type:	Track type tractor referred to as bulldozer
Crew:	1+1 (driver and vehicle commander)
Combat weight without armor kit:	48,520kg
Combat weight with armor kit:	55,800kg
Engine:	3408E HEUI 8-cylinder 18-litre diesel
Maximum road speed:	11.9km/h (forward), 14.7 km/h (reverse)
Track:	Caterpillar metal track
Gross power:	354kW (474hp)
Flywheel power:	306kW (410hp)
Length x Width x Height:	8.1m x 4m (including blade) x 4m
Electrical system:	24V
Equipment:	Large front-mounted dozer blade and rear-mounted large ripper
Blade size:	1.8m high x 4.58m wide
Blade capacity:	13.5 m^3 with SU blade; 16.4 m^3 with U blade
Unit price:	US$1 million
Manufacturer:	The D9 bulldozer is made by Caterpillar Incorporated, Peoria, Illinois, USA. The armor kit is made by Israeli Military Industries.

Technical Data for Caterpillar D7G Bulldozer

Vehicle type:	Track type tractor referred to as bulldozer
Crew:	1 (driver)
Combat weight without armor kit:	20,094kg
Combat weight with armor kit:	23,178kg
Engine:	3306T diesel engine
Fuel tank capacity:	545 liters
Track:	Caterpillar metal track
Flywheel power:	149kW (200hp)
Length x Width x Height:	6.9342m x 3.6576m x 3.3528m
Electrical system:	24V
Equipment:	Front-mounted dozer blade and rear-mounted ripper or winch
Manufacturer:	The D7G bulldozer and its homogenous steel armor are made by Caterpillar Incorporated, Peoria, Illinois, USA.

In August 2005, Task Force "Big Nasty" deployed to the Tall Afar region in support of the 3rd Armored Cavalry Regiment. The mission of the D9s was to build a berm around the insurgent-plagued city in order to cut lines of communication. Here "Natasha" and "Scarface", two D9Rs of the Task Force, can be seen working on the ten-foot high berm on the western side of the city.

Task Force "Big Nasty"

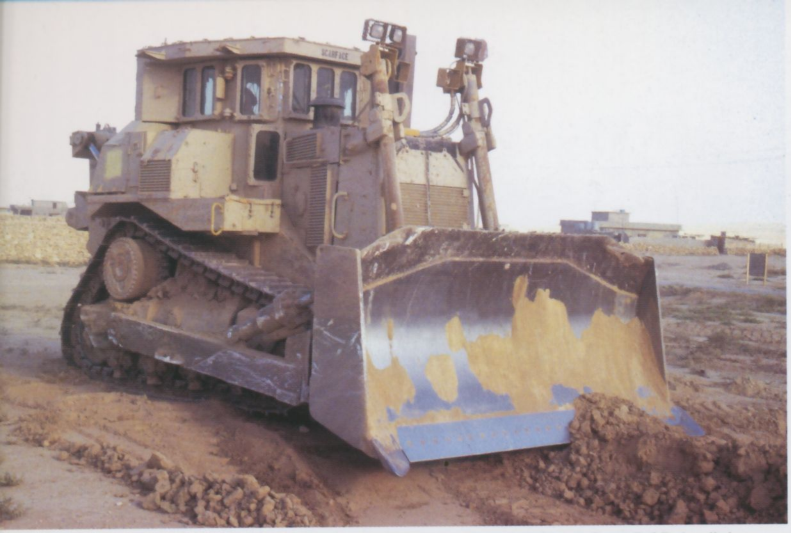
Huge clouds of dust linger in the air, obscuring vision over the worksite. A mixture of engine noise and the metallic clapping of tracks can be heard. The ground is shaking like it does during a small earthquake. Out of the dust cloud, a large pile of rubble appears moving inexorably forward. Behind the rubble a gigantic dozer blade slowly becomes visible. The top of the blade reflects the bright Iraqi sun and like a monster the rest of the large bulldozer appears out of the cloud. On top of the 55,800kg machine, an armored crew cab featuring the name "Natasha" is visible. In the distance another monster bulldozer can be seen using its ripper to tear open the hard desert soil. The vehicles are Caterpillar D9R bulldozers that are working on a three-foot deep ditch and a ten-foot high berm running around the northern Iraq city of Tall Afar. The bulldozers belong to Task Force D9, also known as "Big Nasty".

Task Force D9 – "Big Nasty"

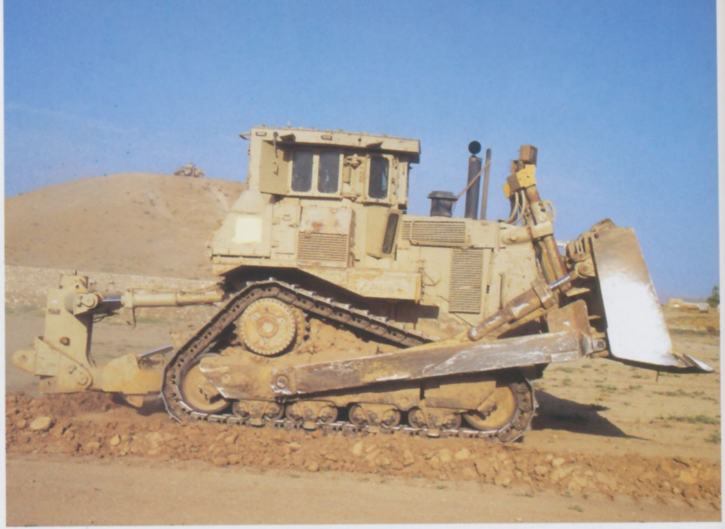
In August 2005, Task Force D9 "Big Nasty" was based at LSAA south of Balad. The unit belonged to the 507th Engineer Battalion, which is part of the 30th Engineer Brigade. The battalion was a combination of Army National Guard, Army Reserve and Active Duty companies. Task Force D9 consisted of eighteen soldiers drawn together from all over the battalion. Some of the engineers were even attached from other units such as U.S. Air Force Engineers or from A Company, 107th Engineer Battalion (Heavy Construction). The vehicle pool of the Task Force consisted of five D9R bulldozers and a couple of wheeled support vehicles. Each of the D9s featured a name: "Scarface", "Gladiator", "Natasha", "Critter" and "Kracy Kracker". "Big Nasty" was a theater asset and therefore operated all over northern Iraq. For transportation the unit relied on other units, as it did not have its own HETS, the heavy transporter that is required to move the 55,800kg monsters around. This sometimes resulted in delays for the unit when deploying to and from LSAA. The mission of Task Force D9 "Big Nasty" was to provide heavy plant engineering support for Coalition Forces. What the unit got up to is easier to understand by describing some of the missions it had fulfilled up till mid-August 2005. In Mosul the unit cleared buildings away in order to establish a security perimeter around government installations. This was done under the threat of insurgent snipers. For the huge bulldozers this was an easy task, as most of the buildings were just nudged, causing them to collapse, and then the rubble was pushed aside by the blades of the bulldozers. The crews were safe from enemy fire, well protected by the D9's armored crew cabs. At FOB Q-West, the bulldozers demolished a palace building and similar work was carried out at FOB Endurance where damaged buildings were taken down. At FOB Moraz the bulldozers cleared an area littered with UXOs by just pushing through the area. The huge blade and the armor of the bulldozers again protected the crews from being injured when some of the UXO went off.

The Tall Afar berm

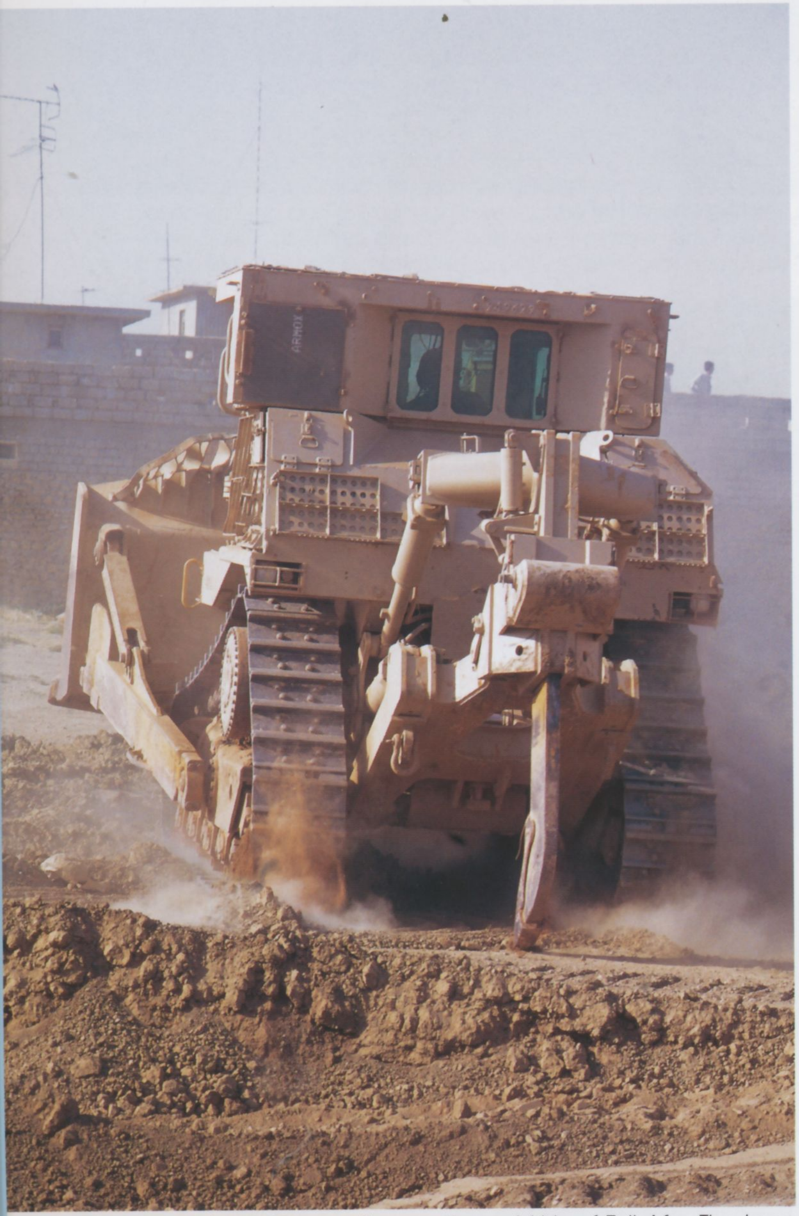
In late July 2005, three D9R bulldozers of Task Force D9 "Big Nasty" deployed to Tall Afar in order to support the 3rd Armored Cavalry Regiment. The mission for the bulldozers was as follows: "Build a ten-foot high berm around the city in order to cut the lines of communication for insurgents using Tall Afar as a first stop after filtering into Iraq over the Syrian-Iraqi Border." As easy as the task may have sounded, it soon became dangerous. The D9Rs deployed early every morning to the berm working area. Work started after refueling the D9Rs around 0500 hours in the morning and went on till the early afternoon when the heat inside the bulldozers' armored crew cabs, despite the air conditioning, became unbearable for the crews. With this routine in motion it was only a question of time before an insurgent attack would hit the Task Force and the security asset provided by the 3rd ACR. The first two attacks took place on 26 July 2005 when the D9s received heavy small-arms fire. A third attack took place on 28 July, but this time it was a combination of mortar fire and small-arms fire. While the D9s took some hits on both occasions, the attacks were beaten off and the work continued. There were several attacks with small-arms fire in the following days but the insurgents learned the lesson that they could not stop "Big Nasty". Tall Afar saw Task Force D9 working for two weeks to build 11.5km of berms. The remaining parts of the berm surrounding Tall Afar were built by engineers of the 3rd ACR with their unarmored D7 bulldozers under cover of darkness and using night vision equipment.



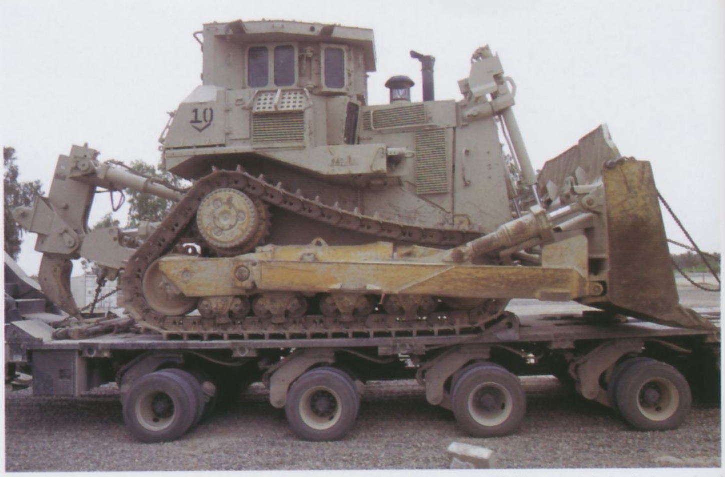
In August 2005, Task Force "Big Nasty" could field five D9R bulldozers. While this one is called "Natasha", the others were given the following names: "Scarface", "Gladiator", "Critter" and "Kracy Kracker". All D9Rs are fitted with the add-on armor kit designed, produced and installed on the vehicles by IMI, this bringing their combat weight to 55,800kg.



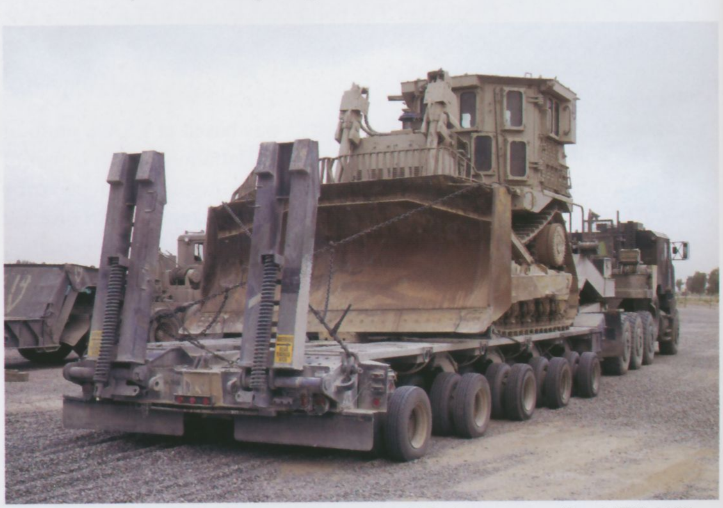
With its large rear-mounted ripper, a U.S. Army D9R opens the ground on the outskirts of Tall Afar. The ripper can penetrate the ground up to a distance of 1.7m. Visible is the vehicle's armor-protected crew cab. The cab, which features windows of bulletproof glass, can withstand a direct hit from 12.7mm ammunition. The armor also protects the crew from the effects of mine blasts and is able to stop 155mm artillery shell splinters.



Rear view of a D9R operating on the outskirts of Tall Afar. The large ripper with its hydraulic assembly and the metal caterpillar track are in full view. The frames on the rear and sides of the crew cab are designed to accommodate ERA elements to provide additional protection for the crew if required



This D9R was seen at LSAA in June 2004. The 55,800kg vehicle is loaded on the M1000 semi-trailer of a HETS. Note the D9R's two hydraulic arms that are used to lift and lower the blade. Also visible are two more hydraulic cylinders that are used to tilt the large U-Blade. Also observable is the rear-mounted ripper and the drive sprocket, which is mounted higher then the remaining running gear, thus allowing the bulldozer to possess a higher ground clearance.



For moving the D9Rs around Iraq, the U.S. Army uses the HETS. With a payload of some 63,500kg, the tank transporter was primarily designed to carry the M1 Abrams MBT. With a combat load of 55,800kg, the D9R with its IMI add-on armor is a similarly challenging load. In view is the large U-Blade of the bulldozer that can move 16.4m^3 of soil at any one time.

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